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COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Vol. xxiii JANUARY, 1918 No. 1

FIG. I. MOUNT ROYAL TUNNEL. A NOVELTY IN PHOTOGRAPHY

TO GET A GOOD PHOTOGRAPH OF A TUNNEL

We are all sufficiently familiar with photographs of tunnels which cannot be called good pictures and which fail to show the interiors with detail and clearness. Photography under ground has been at its best a disheartening job, but we are assured by Mr. J. C. K. Stuart, Assistant Engineer, Mount Royal Tunnel and Terminal Company, in Electric Railway, that with practice and experience results can be obtained in tunnel photography that are almost as good as those obtained by daylight, and with very simple artificial lighting apparatus. The photo of the interior of Mount Royal tunnel here reproduced seems to fully corroborate the statement.

The trick consists in using a portable lamp, with reflector, which is moved along to successively illumine all parts of the interior which is to be photographed. The camera needs no description—almost any type will serve—but an anastigmat lens of the cemented type will give negatives that are more brilliant than a lens of the air-space type under tunnel conditions. There is no need for a large aperture. Most of the photographs used by Mr. Lancaster, who has been most successful in this work, were taken with the lens stopped to full. The plates must be backed or double coated. The lighting apparatus consists of a 1,000-watt, 110-volt, tungsten, concentrated filament lamp mounted in a mirror reflector, designed in such a way that the light from it is very evenly diffused, with no concentrated ray, but only one small dark spot in the center of the circle of illumination. The reflector and lamp are shown in Fig. 3.

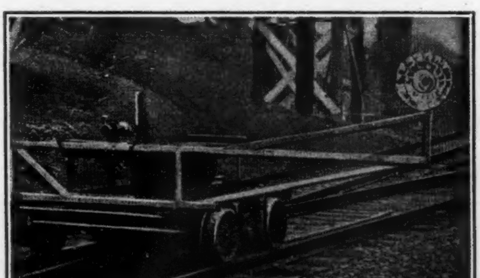


FIG. 2. CAR AND LAMP

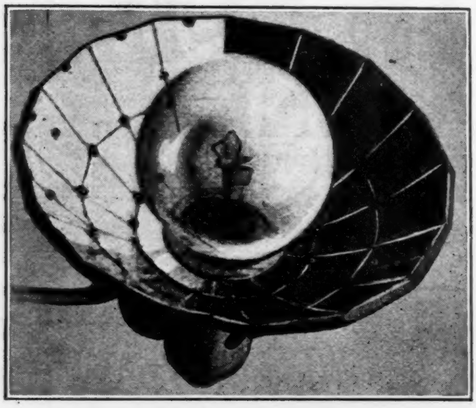


FIG. 3. LAMP AND REFLECTOR

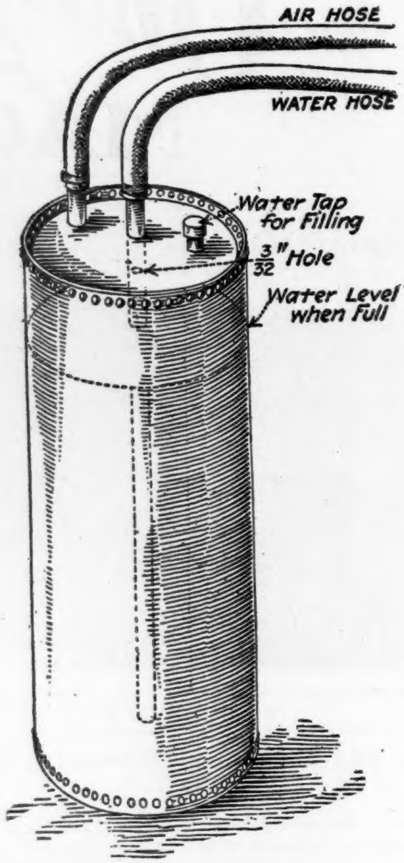
To obtain a long perspective of a tunnel the lamp must, of course, be carried down the tunnel ahead of the camera and pointing away form it, thus illuminating every part of the tunnel successively, starting directly in front of the camera and ending, say, 1,000 ft. from it, or whatever distance is required in the photograph. The lamp may be carried in the hand and current fed to it by a wire of the required length attached to the tunnel lighting system, but for long perspective views it is better to mount the lamp on a small push car connected to an electric locomotive about 250 ft. away by means of a light rope and a wire for furnishing the current to the lamp. The man attending the lamp must keep his body between the lamp and the camera, or else the light from the ventilating holes in the socket will strike the lens.

If any hitch occurs during the taking of the photo, such as the catching of the wire in the track, necessitating a stop, the lamp man puts out his lamp until all is clear, lighting it again as soon as he starts to move on.

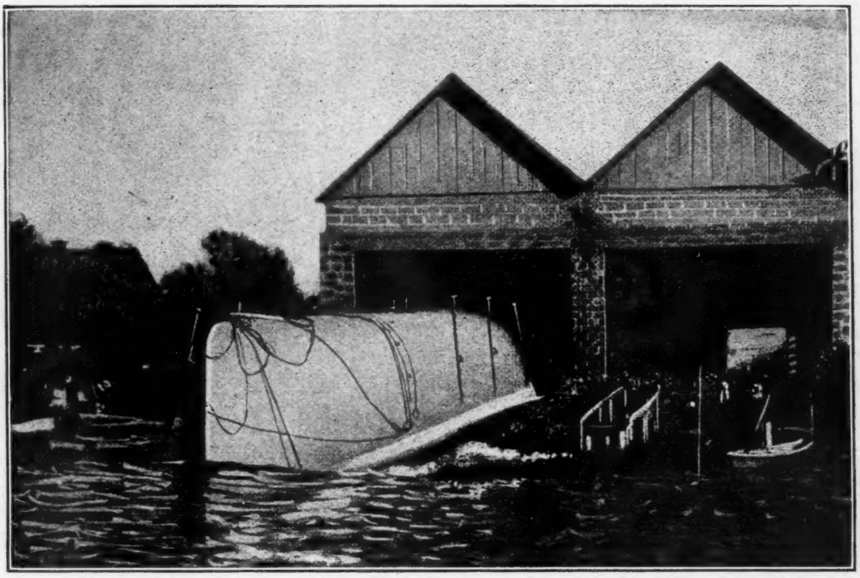
A few experiments will give the right speed of the lamp for the correct exposure of the plate for different sizes of tunnel, but as the distance from the camera to the lamp increases the speed at which the lamp travels must increase.

AIR AND WATER TANK FOR MACHINE DRILLS

The common form of tank for supplying water to machine drills may be improved by



a simple alteration that makes the water supply to the drill hole more effective in blowing out the sludge. In ordinary operation when the tank is filled with water and the drill running the air pressure in the tank forces the water through the water hose to the drill and into the drill hole. While the water is effective in allaying dust and will wash out holes in hard ground which point upward, the pressure is not strong enough to clean downward-pointing holes, or holes in ground that makes a sticky sludge. To remedy this, a simple change was made, which works satisfactorily and is shown in the accompanying illustration. A $3/32$-in. hole was drilled in the water-feed pipe above the highest water-level, so that as the air pressure is applied to the tank, bubbles of air enter the water as it passes through the pipe to the drill. These bubbles of air burst when they reach the bottom of the drill hole

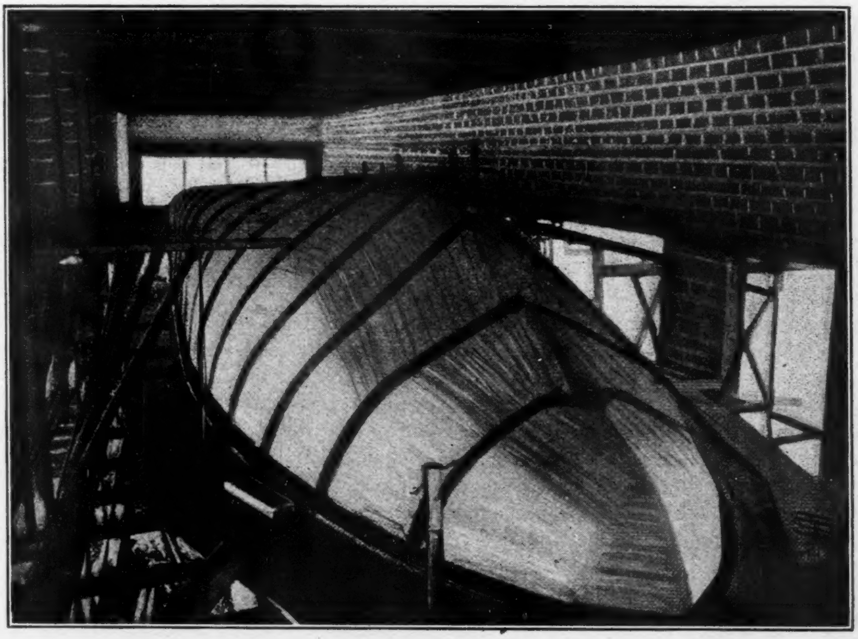


THE LAUNCHING OF THE CONCRETE SHIP

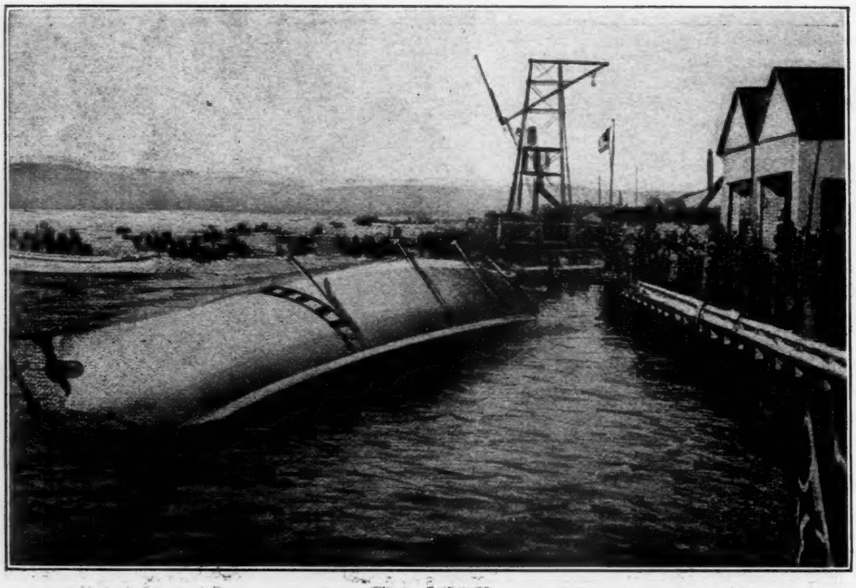
and the mixture of air and water is more effective in throwing the sludge out of the hole than the water alone. The hole in the water pipe must be small in order not to admit too much air, which would reduce the pressure on the water.—*Eng. and Mining Journal.*

THE LAUNCHING OF A REINFORCED CONCRETE SHIP

Whatever might be our belief as to the practical value of reinforced concrete for the hulls of ships, the problems involved in their construction could not fail to be of interest, and



MOLD FOR INTERIOR OF SHIP



BEGINNING TO TURN

our readers, we doubt not, will welcome the half-tones on the opposite page. The photos were taken at Porgrundo, Norway, in August, 1917, and they show us the final incidents in the launching of the Beton, a reinforced concrete motor ship of 200 tons.

This ship was built not in the normal vertical position but with the keel on top, the advantage of which so far as the constructive operations were concerned, must be sufficiently evident. A mold the shape of the interior of the hull was built of wood and upon this the interlacing steel reinforcement was placed and then the concrete was poured to the required thickness, a very simple operation. The mold was built upon a broad, flat surface and as the mold and hull were launched together the usual difficulties were avoided. Then came the operation of turning over the hull to bring the ship right side up, and the pictures tell the story of this without much call for words of explanation.

The mold was divided into a number of closed side compartments with an open space in the center, and by admitting water on one side while retaining the air or increasing the air volume on the other side the preponderance of weight soon turned the hull over to the required normal position. The water was then pumped out, the mold was removed and the operation was complete. The righting of the hull after the launching required only fifteen or twenty minutes.

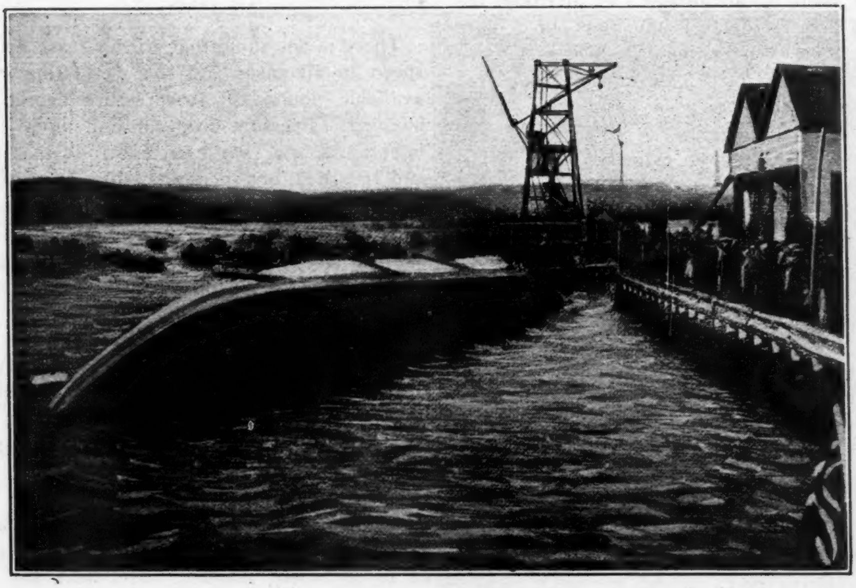
SPEEDING UP THE DRILL

There has been considerable discussion and much earnest effort in attempts to get more work out of machine drills. There are many ways in which this may be accomplished, but there are also many obstacles when it comes to active practice. It is the object of this article to briefly outline some of these methods and to describe one in particular.

In analyzing the cost of breaking rock it has been found that the greatest item of expense is miners' labor, and the labor situation of today is such that it is poor policy to try to get any more work out of a man. The only way out of the difficulty is to make possible for a man to do more work without expending any more energy. In view of such considerations methods of speeding up the drill seem to offer the best solution and these group themselves under the following head: (1) Increasing the actual drilling time of the machine. (2) Increasing the reciprocating speed of the machine.

ACTUAL DRILLING TIME

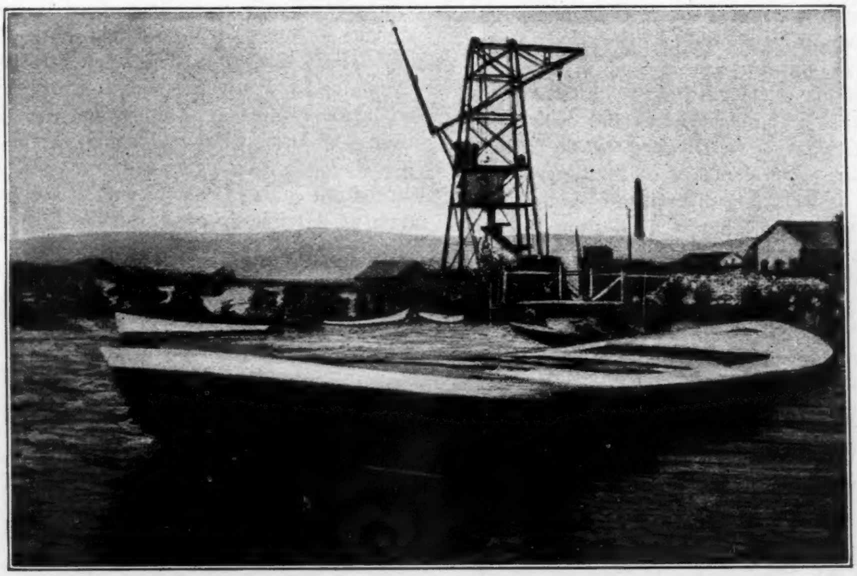
The importance of the first factor is realized by few. A little time spent with the stop watch will show that machines are actually operated from 25% to 50% of the total shifts' time, or



HALF WAY OVER

from two to four hours of the customary eight. Personally, I have never known one to run as high as four hours out of eight. The rest of the time is spent in various other operations, such as "mucking back," mounting, changing drills, moving the machine, tearing down, loading and firing the holes, etc. All these things have to be done by the miner and take up a large part of his shift.

The diminution of such delays in drilling must be made according to the conditions in various places. In a general way only a careful study of delays will suggest remedies. In many cases lighter machines and mountings



READY TO BE PUMPED OUT

can be used to advantage. In drifting the miner's greatest delay is mucking out a place for his post. Where there are two 6- to 8-ft. wide drifts not too far distant on the same level, the following is a good time-saving method:

Instead of using one machine per shift in each drift, work both machines in one drift on the day shift and move them to the other on the night shift. In the mean time the first drift is mucked out and ready for a clean start on the following day shift. This adds from one to two hours to the available drilling time. Needless to say, the miners are glad to be relieved of the strenuous mucking at the start of the shift. There is no additional labor involved in this arrangement and it is only impracticable where the ground is so soft that there is not enough drilling in a round of holes to keep two machines busy for a shift. Careful attention to the supply and quality of drill steel will also help to increase the machine's running time. These are merely suggestions and may not apply in all cases. Some day the rock-drill manufacturers will devote more time and study to the designing of a machine that will facilitate the changing of drills and other operations that mean lost motion to the miner.

RECIPROCATING SPEEDS

In the second method of speeding up the drill it is evident that, if a machine is only reciprocating from two to four hours in a shift, everything should be done to get a maximum amount of hole drilled in that time. This means a close study of different types and makes of both machines and drills to determine what is best suited to the ground. There are several makes of machines on the market as well as a diversity of opinion as to which are best. That is a question that can only be decided by experiment in each case. The same applies to various types of drill bits. Of course, a small hole can be drilled faster than a large one and here we have the big advantage of the Carr bit with its small gage changes. On the other hand, a small hole will not hold so much powder. In the latter case the solution is either to use stronger powder or place a smaller burden on each hole. The powder solution is preferable, of course, but there are mines where the ventilation is too poor to care for the larger volume of fumes that come from powder of greater strength.

AIR PRESSURES

There is one thing that will increase drilling speed in all cases and that is getting every available pound of air pressure behind the hammer. Pressure-drop through pipes, hose, inlet ports, etc., has been carefully measured and recorded, but there are still a surprisingly large number of mines where no attention is given to such matters. To put the loss in drilling speed into something more tangible than merely the pounds drop in pressure, an interesting test was conducted.

A place was selected where there were two machines in good condition, supplied with air through oversize pipes to insure a maximum pressure. A glove valve was inserted in the pipe line near the machines, and a pressure gage attached between the valve and the machines. For an entire shift the pressure was kept down to 55 lb. by manipulating the valve, and the drilling speed of the machines recorded in the usual manner. The next day the test was repeated with a constant pressure of 70 lbs. This 15-pound increase in air pressure increased the drilling speed by 37 per cent. By drilling speed is meant inches drilled per minute of actual reciprocating time. The result obtained was almost startling although the test was simple and easily performed. A 15-lb. drop in pressure is quite common in conducting compressed air through pipes, but a difference of 37% in drilling speed is enough to make anyone "sit up and take notice." In this particular case it led to a careful investigation and to the adoption of certain standards in regard to minimum size pipes, hose, inlet ports and connections. The air-pipe equipment of each level was carefully worked out so as to comply with a fixed maximum permissible drop in pressure.—*Eng. and Min. Journal.*

More than 400,000,000 ft. of Southern pine (approximately 20,000 carloads) has been purchased by the Federal Government through the Southern Pine Emergency Bureau for the war needs of the nation here and abroad, according to figures compiled by the Bureau. This is additional to about 375,000,000 ft. of timber being placed through the Bureau for the construction of 250 ships. The total makes by far the biggest lumber order in the history of the world.

AIR DRIVEN PORTABLE COLUMN HOISTS

BY L. H. HICKS

A detail of mine operating costs which has commanded considerable attention recently is the man-power cost of hoisting, handling and hauling light loads. That machines be substituted for men on odd jobs and temporary work as well as on the more important mining operations is highly desirable in view of the increasing wage demands. Many needs for portable power have been met by the mine column hoist, which is compact, easily installed and air operated. Mining men in general have become well acquainted with these little machines, Fig. 1, in hoisting the light loads incident to the sinking of a winze or driving a raise. Hauling cars in and out of small drifts is also a common application, but there have developed recently a number of unusual and interesting ways of applying these portable hoists.

In sinking prospect shafts column hoists have been used to handle nearly everything, as the little two-drill compressor commonly used supplies plenty of power for hoisting when the drills are not working. In the larger sinking operations these hoists have been used to handle sinking pumps, for hoisting the drilling machines before shooting, and to put piping, conduits, etc., in the shaft. In winzes and raises they handle drills, steels, powder, timbers and muck—and men, too, when the bosses aren't around. As auxiliaries to the regular mine hoists needed in the larger winzes,

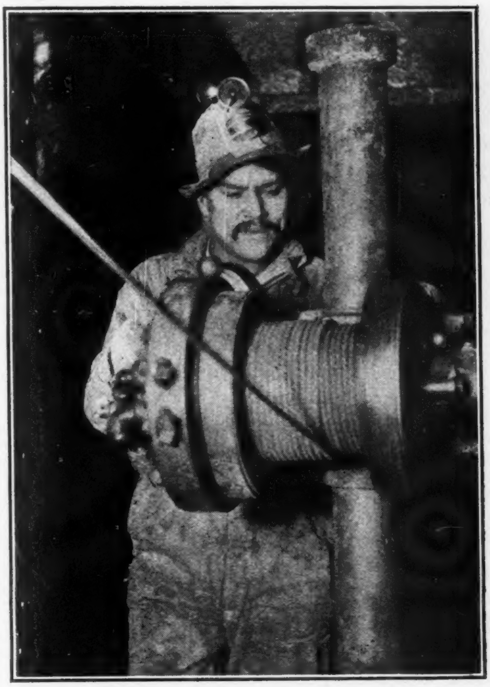


FIG. I

FIG. 2

column hoists have proved labor savors in bringing the rope back to the bottom which, when done by hand requires several men. One little hoist, bolted to a truck, is transported through a Butte mine for all sorts of odd jobs.

The Alabama red-ore mines employ column hoists in drifts where the grade is too steep to push an empty car by hand or to haul it with a mule and the down grade is not sufficient to keep the cars moving by gravity. In some of the Michigan mines where it is necessary to move the tram cars on 30° slopes between levels, hauling up empties and lowering loaded cars, the work is efficiently done by these small machines which handle some remarkable loads. At an Illinois mine they haul loaded cars, weighing 2,500 lb. each, up a 30° incline, and in New York two 8½-ton cars up a 6% grade.

Pulling timbers from old workings is another field in which one man with a column hoist can do as much as from two to six workmen. Most of the machines use wire hoisting rope, but at Butte there is a strong preference for manila. The uses of column hoists above ground are, if anything, more varied than under ground, ranging from removing dirt from a foundation excavation to driving a tumbling barrel by belt from the rope drum. In the latter case, drill steel is tumbled to clean it for electric welding. At an Alaskan mine a Little Tugger hoist, Fig. 2, is used at the sawmill for hauling logs from the water up the beach to the lumber pile, and then to pull the logs along in front of the saw. There are reports of similar hoists handling heavy mine timbers at lumber piles in other districts. One of these machines has been utilized at another mine in Alaska to pull 50-lb. steel rails through a rail bender, as already described in the *Journal*. At stlll another mine, all the fuel oil and supplies are hauled up an incliune tram with a column hoist, as labor is too expensive.

At a mine in Cuba two of the hoists have been placed on locomotives and are used to haul cars in and out of sidings to save switching the locomotive itself. This, however, might not be considered practicable in many cases. To prevent the flow of water into a mine in Arizona dozens of holes were drilled to bedrock and slime was pumped in under pressure. The slime "sets" like cement, and it was believed that a portion of the faults could be

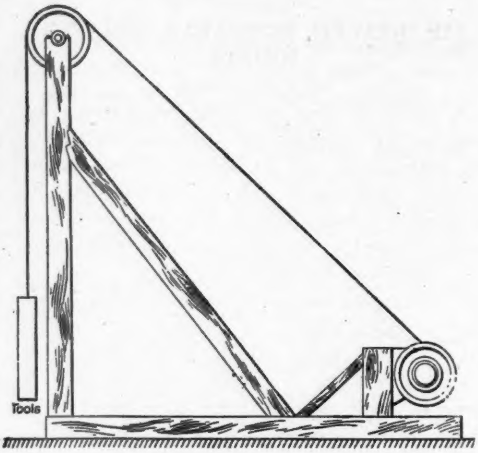


FIG. 3

filled up and the pumping costs reduced. The drilling rig Fig. 3 was similar to a churn drill, the actuating power being a portable column hoist. The string of 3-in. tools was raised by the hoist and allowed to drop of its own weight and by this method 30-ft. holes were satisfactorily sunk.—*Eng. and Min. Journal.*

ECONOMY OF TIGHT AIR HOSE CONNECTIONS

BY GLENN B. HARRIS

In the use of compressed air it is essential that tight joints be maintained, not only throughout the pipe line, but at all hose connections on the latter, and the connections between the hose and the tools being operated. This is necessary not only that the tools receive air in proper volume and pressure for their efficient operation, especially where compressor capacity is deficient, but also as an economic proposition of no small magnitude.

When it is taken into consideration that 5 cu. ft. of compressed air at 80-lb. pressure will flow through a $^1/_{16}$-in. opening in one minute, and that it requires one horsepower for the production of the amount of air named at the pressure given, the expediency of conserving the air supply in all ways possible is self-apparent.

In some plants attention is given to this feature of economy, while in others it remains uncared for, and absolutely neglected.

Pneumatic tools, as a rule, are operated by unskilled laborers who know nothing of compressed air, except that it makes their machine go. They know nothing of its cost of pro-

duction, and care less. If there is a leak present at their machine, they make no effort to prevent it, nor trouble to report it.

In small shops where the number of tools in operation is comparatively few, the foreman should make it a part of his daily duties to inspect all hose and hose connections, and also the iron pipe line, to ascertain as to their tightness. Frequently the globe valve on the iron pipe line is not tightly turned down to its seat, then, too, grit or scale may be present to prevent the proper seating of the valve, or the valve itself may be leaky. Any of these causes contribute to unnecessary waste of air, and as shown this unnecessary waste is an expensive proposition, especially in large plants, where hundreds of pneumatic tools are in operation, and practically miles of piping employed in order that the tools may be utilized at convenient points.

In most plants, where a very large number of pneumatic tools are employed, it is usual to detail one man whose sole duty it is to inspect the pipe lines, valves, hose and hose connections and couplings to see that leaks are not present, and if so to immediately give them proper attention. This should be the practice in all plants of any considerable size. The expenditure for this inspection may seem an unnecessary one, but it will be found a paying proposition in the long run.

LOOKING FOR LEAKS

A leak at the joints can be readily accertained by applying a torch, or by the application of a small quantity of water, which latter will of course bubble if there is an escapement of air.

In looking for leaks at the tool end, the tool should be stopped by closing its own throttle. The leak if present will be readily apparent by the sound of the escaping air, although probably the surest means which can be employed are the torch or water.

If leaks are located in the hose lines it will prove profitable to immediately cut out the leaky portion and couple up by means of pipe nipples. If the hose becomes worn or leaky to the extent that a number of connections are required, it will prove economical to dispose of the leaky section or sections.

A first-class quality of hose and rubber tubing should be employed, while it may be expensive in first cost, it will prove cheaper in the end than hose purchased at a low price. The latter as a rule will develop leaks in a brief period of time, and will quickly rot out under weather conditions. In addition to this it is so loosely put together, and the materials employed are of such poor quality, that it will not withstand the air pressure of from 80 to 100 lb. per sq. in., at which pressures pneumatic tools are most generally operated.

THE QUALITY TO USE

As before stated, the hose and tubing should be of first-class quality, and the long sections should be wound with galvanized wire, which will serve as an efficient protection against abrasion or cutting in dragging around the shop or yard. It should be at least six-ply, and the tubing which connects the tool with the long length of hose should be oilproof on its interior surface as the lubricant is usually introduced to the tool through this short section of tubing.

If a poor quality of hose or tubing is used it will hardly be possible to obtain the best results from the pneumatic tools. Delays will occur due to the periodic closing of the ports by the accumulation of rubber in the air passages.

It requires an expert to detect the difference between good and poor hose, and even the best of it undergoes a continuous deterioration in value.

The short section of rubber tubing is employed in order that flexibility of the tool may be obtained, and as much weight as possible removed from the operator. This short section of tubing remains, so to speak, a fixed part of the tools to which it is connected.

THE COUPLINGS

In order that the connection between the tubing and hose may be expeditiously and tightly made various types of quick-acting couplings have been placed on the market. Several of these possess merit in a considerable degree, and can be used to great advantage.

One of the most efficient couplings which ever came to the writer's notice was in use in a large shipyard located on one of the Great Lakes. This coupling was somewhat cumbersome and heavy, and these two drawbacks in connection with its expense, seriously militated against its more general introduction, notwithstanding its great merit.

The coupling referred to consisted of two sections, male and female, designed to be screwed together. These sections were placed

on the hose and tubing, and expanding nipples were forced into the ends of the latter to a point where the rubber would project about 1/8 in. The distention of the hose and tubing, as a result of forcing the nipples to place, prevented the hose or tubing from drawing out of its respective section. When the coupling was connected up, the ends of the hose and tubing abutted, and when the coupling was tightened the rubber ends spread, and an absolutely perfect seal was effected. In making an examination not even the slightest leak in more than three hundred couplings could be discovered.

AUTOMATIC VALVES

To add to the efficiency of their air system, the branches of the main pipe line were equipped at suitable intervals with what might be termed automatic valves. These valves were so constructed that when the nipple on the end of a hose section was screwed to place the valve was opened, and air permitted a free and untrammeled passage, and when the nipple was unscrewed a short distance or removed entirely the valve automatically closed. This permitted cutting off air to the hose line without detaching the latter, and also prevented leakage through inadvertance in not properly turning down the valve to its seat. The advantages gained by the use of the couplings and connections described amply repaid for any increased cost of installation.

There are a number of very efficient couplings to be had at a small cost. Any of the well-known manufacturers of pneumatic tools is in position to furnish a coupling which will prove entirely satisfactory in use.

DIFFERENT TYPES OF COUPLINGS

It is not the intention of the writer to differentiate between these couplings so far as merit is concerned, but only to briefly refer to their construction, and operation and to present the advantages claimed for them.

One of the most efficient couplings has had a wide and extended sale, and seems to meet all requirements. These couplings are interchangeable one with the other in sizes from ¼ in to ¾ in., inclusive, while sizes 1 in. and 1¼ in. interchange. These couplings are almost instantly connected and should be air-tight under all reasonable pressures.

Another coupling is extremely ingenious in its construction, and is universal in all respects, neither half is male or female, but a combination of both, which permits a ¼-in. hose to be coupled to a 1-in. pipe, and ½-in. hose to 1-in. hose. In other words any size will couple to any other size whether it be larger or smaller. The gaskets are so placed in the two halves of the coupling that it is impossible for them to drop or be blown out when disconnected.

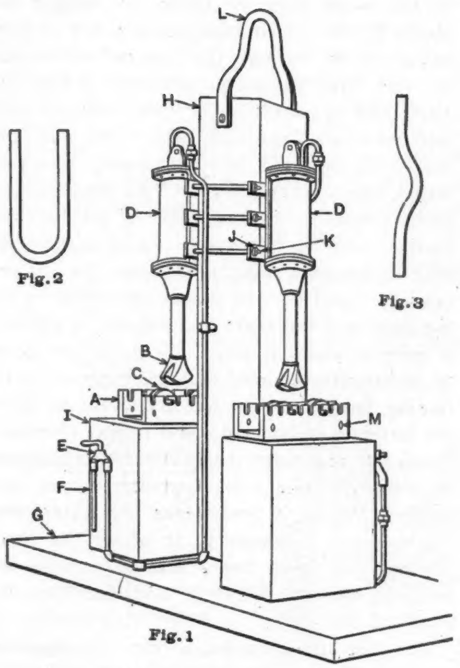
There is also another coupling like the two couplings previously mentioned which is adapted for universal use, that is hose of ¾ in. diameter may be connected with hose up to 1 in. diameter, and this without any reducing. It only requires a third turn of the hose to effect a union. Like other couplings, leaky joints are hardly possible.

The couplings referred to are all light in weight, and offer no detrimental obstructions, in fact this feature is one that has been worked out so far as could be with good results.

Another very essential point in the conservation of compressed air, is that where the nipple enters the hose or tubing, great care should be exercised to see that the nipple is tightly secured in place. It proves expensive, if a riveting gang of three men is stopped at their work while a nipple which has blown out is being replaced, and especially so if the blowing out occurs at the time a rivet is only partially driven. The nipple should have a grooved, or cut, face in order that the hose may sink into these grooves, or cuts, and thus be firmly held by the wire band or clamp, whichever may be employed.

If attention is given to the saving of air through maintaining tight connections at all points, the compressor capacity is relatively increased, and the coal bill is proportionately diminished.—*American Machinist.*

Even small economies are not to be overlooked in these times. The cost of writing ink has advanced more than 100 per cent., while very satisfactory ink can be made from discarded copying type writer ribbons. Instructions for the making, as given out by the M. K. & T. Ry., are as follows: Fill a quart bottle with water and allow the ribbon to soak twenty-four hours until the coloring matter has been dissolved. The result will be a good grade of writing ink—as good as can be purchased on the market. It may be used in fountain pens.



PORTABLE AIR OPERATED TUBE BENDER

Having various sizes of tubing to bend and set up in different parts of the factory, it was decided to make, at small cost, a machine that could be brought close to the job being set up, and thus save the time spent in going to the machine to make the bend and then back to the work to try the tube in place. Most of the work was special and required more or less cutting and trying so as to make a good job. The machine designed is shown in the accompanying illustration. It was made in tandem so as to enable two men to work simultaneously or so that each side could be set for a different bend, thereby elminating the necessity of changing the positions of the rolls. One of the air cylinders *D* is twelve inches by twelve inches and the other is eight inches by twelve inches, as these were on hand.

The roll-holder *A* has several slots on each side, cut opposite each other, to hold the shaft that contains the rolls; these slots are spaced so as to obtain the necessary bends. The holes *M* are used for hold-down bolts (not shown) when bending pipe as shown in Fig. 3. The former *B* and the rolls *C* are made to suit the diameter of tube and the radii of bend. The control of the cylinders *D* is obtained by the air valve *E*, which is connected to the main line by a flexible shaft *F*. The frame of this machine, consisting of the base *G* and the uprights *H* and *I*, was made of heavy pine logs bolted together. The cylinders *D* are bolted to three steel straps, which are held to the column by six heavy bolts *J* and *K*. The bail *L* is for the crane hook. Figs 2 and 3 show two of the bends that are made; right-angle bends can be made, if desired, by strapping down one end of the tube. Miscellaneous straps and bolts are used in connection with the bending, but are not shown.—*G. E. P. in Machinery.*

EMPLOYMENT OF DIVERS IN SHAFT SINKING*

H. GRAHN.

Of late years the employment of divers in shaft sinking has proved very useful for a number of purposes, in the Bochum district, including the fitting and removal of pump strainers, the examination and freeing of sinking shoes, overhauling shaft pumps, replacing cables disturbed by the influx of water, etc.

At one pit in the Witten district, when the shaft had been carried down to about 25 yds., a feeder discharging some 250 gals. of water per minute was tapped at about 125 yds. by a 12 in. borehole in the shaft bottom, this hole being kept open by a wire rope which could be raised or lowered from bank or from the shaft bottom. The casing inserted in the borehole in its upper portion, which passed through loose rock, was closed by a fluted, taper wooden plug, a certain amount of the water being allowed to escape through the grooves in the plug and perforations near the top of the casing. When the lower portion of the shaft was being lined with concrete, a pile of rough stones was made round the projecting end of the casing; and, to facilitate the setting of the concrete and maintain a counter pressure in the interior of the shaft, the water was allowed to rise nearly to the level of the staging. Owing to some of the concrete having run down into the pile of stones, the wooden plug was found to have jammed, and could not be pulled out; and the

*Colliery Guardian, Translation from *Gluckauf.*

water rose to within about 16 ft. of the bank, the shaft being completely flooded.

A diver was sent down for several days to recover the skips and other articles on the shaft bottom, and more particularly to break up the cemented stone pile round the casing, so as to free the plug and the mouth of the borehole. The plug being nearly 5 ft. long, and extendnig for over 3 ft. into the casing, it was decided to bore it out. To provide proper guidance for the boring bar, 65 ft. in length, a 2½ in. pipe was let down, the lower edge being provided with sharp teeth so as to get a good grip into the top of the plug, the diver holding it in position until the boring tool was deep enough into the plug. Through the 1½ in. hole thus formed, the water was allowed to run for several days, at the end of which time, however, another stoppage of the borehole occurred and necessitated the aid of the diver in boring through the plug again. The borehole was then flushed out thoroughly, and a rod, composed of railway rails, lashed together, was lowered into it and suspended from an iron girder on the shaft bottom, so that, as sinking progressed, the girder and rod descended automatically by their own weight and prevented the hole from choking up again. This done, sinking was continued without any further water troubles.

During the difficult operation of unwatering the State colliery at Waltrop, divers were frequently employed. At first an attempt was made to cope with the extensive inrush of water—amounting to nearly 4,000 gals. per minute—by means of Tomson water barrels. In carrying out this plan, much trouble was experienced with the flat winding ropes used, these being severely strained by the great weight of the ropes themselves and the full barrels, and jamming in the winding bobbins. Moreover, when little progress could be made in lowering the water level, the repeated splashings of the saline mine water every time a water barrel was lowered acted on the pitch-pine guides and softened the timber, which then easily broke. This entailed repairing the guides under water, the divers having to work at a depth of about 70 ft. Eventually, however, the work of unwatering with barrels had to be given up, owing to the above-mentioned rope troubles, and carried out by means of mammoth pumps, arranged in series.

Considerable practical importance attached to the work done by divers in sinking two shafts by the cementation process, one of them being driven through the fissured white marl of the Recklinghausen district. When this shaft had got down to a little over 500 yds., and was only some 150 yds. from the coal measures, one of the advanced boreholes struck the powerful feeder. As there was no stuffing box on the standpipe of the borehole casing, and as the rods, forced up by the rush of water, jammed against the staging near the shaft bottom, it was impossible to cap the pipe, and the shaft soon became flooded to a depth of about 45 yds. The diver sent down to investigate reported that the force of water issuing from the pipe was too great to allow the latter to be capped; and it was therefore decided to rearrange the unwatering appliances in order to obtain a much greater output than before. Within a few weeks the water level was lowered to about 30 ft. above the shaft bottom, this head being left to oppose the stream from the borehole and facilitate the work of the diver.

To plug the standpipe, the arrangement shown in Figs. 1 and 2 was designed, consisting of a tap *a* into which was screwed a tube *b*, tapering at its lower end and provided with threads *c*, intended to cut a thread in the standpipe. The conical portion was continued to a point by means of three pieces of T-section (section A—B, fig. 2). A pipe *d* was secured to the upper end of the tap, to serve as a guide for the winged strap *e*, in which it could move freely until the strap made contact with a fixed collar on the pipe.

The strap *e* was connected to the top of the standpipe by means of 1 in. screw bolts *g* pivoting on a strap mounted on the standpipe, the bolts being long enough (Fig. 2) to allow the tap to be swung. The parts were assembled at bank and taken down by the diver, who, after placing the device in the position shown in Fig. 1, tightened up the strap *f* on the standpipe and swung the tap through an angle of 90 degs., thus bringing the point of the apparatus into the mouth of the standpipe and centering the pipe *b*. On then rotating the whole tap, the taper thread cut its way into the standpipe. To prevent the tap being forced out bodily—the water issuing at the rate of nearly 700 gals. per minute, and under a pressure of about 30 atmospheres—the nuts on the rods *g* were tightened up so as to brace

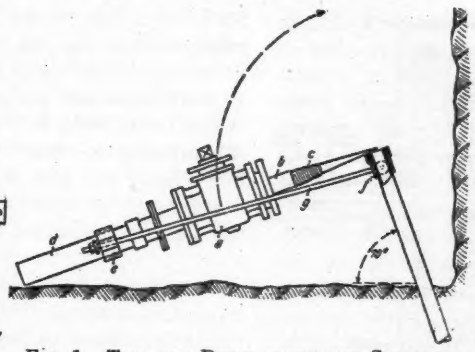


Fig. 1.—Tap and Plug ready for Swinging.

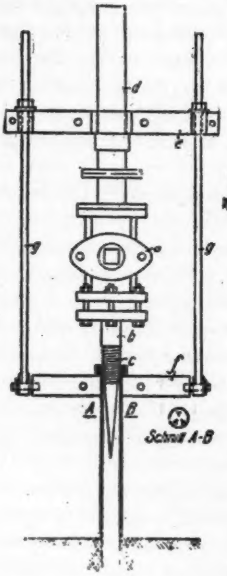


Fig. 2.—Tap Screwed into Standpipe and Secured.

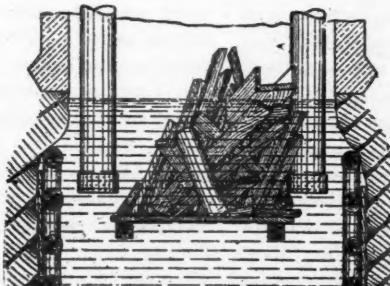


Fig. 3.—Pit Bottom before Clearing by Diver.

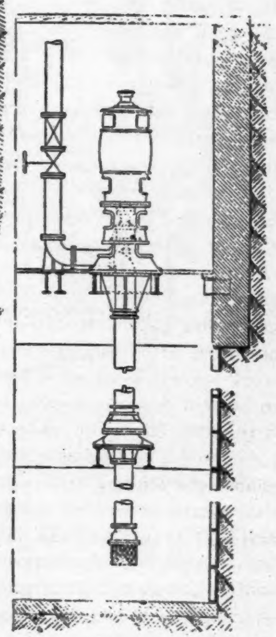


Fig. 4.—Submerged Electric Pump, with Shaft Mounted in Standpipe.

the two straps *e* and *f* together, and the tap was then shut (Fig. 2). In this way the sinking and cementing of the shaft could be resumed, after a stoppage of 13 months, although the rock was extensively fissured with small feeders and several large fissures which had to be stopped with many tons of cement.

A similar case arose in sinking a shaft at the Asse potash mine, through bunter sandstone, by the cementation process. On striking a big feeder, the tap of the standpipe was turned off, but water escaped through a split in the pipe and flooded the shaft. When the pumps had lowered the water to within about 50 ft. of the shaft bottom, a diver was sent down to remove the tap and plug the pipe. The first attempt at plugging, with a couple of steel tubes and rubber washers, failed because the water forced the device out of the pipe, in spite of the free passage left by the tubes. Better results, however, were obtained by the use of a wedge-shaped plug of soft wood, which the diver inserted into the standpipe by the aid of a steel pin 10 in. long, stuck in the point of the wedge, the latter then being driven home by a weight attached to the rope, operated from the surface. This plug proved staunch, and the shaft was pumped dry. By forcing cement down the other standpipes, the other holes, including the one substituted for the first named, were plugged as soon as the feeder was reached in boring; and the sinking progressed to completion without further trouble..

In sinking a shaft, on the left bank of the Rhine, through tertiary rock, with an iron sinking shaft and Priestman grab, the rope broke at about 30 yds., leaving the grab on the bottom. As the grab excavated mainly at the centre, so as to allow the sides to cave and furnish loose soil, the diver sent down had some trouble in locating the grab, and clearing away round it so as to allow a strong cable to be attached. The work was rendered particularly arduous on account of low visibility, the water being laden with fine tertiary sand and loam, and quite opaque at the shaft bottom. Almost similar work had recently to be performed in an iron sinking shaft in a mine in Upper Silesia, the sunken grab having

first to be dredged clear in between 80 and 90 ft. of water. A heavy cable was attached to the grab, and was lifted by means of a steam winch and pulley tackle alternately, the strain pulling a 2½ in. wrought iron hook (about 3 ft. long) out straight. Eventually the grab was recovered by exerting a gradual pull on the rope.

In sinking the Adolf shaft of the Eschweiler Company, it was found impossible to force the sinking shoe down below about 20 ft. above the coal measures, even after boring out the shaft completely; and on this account a concrete plug was prepared on the shaft bottom and then bored through. In the course of this work several leaks were made, and a diver had to be sent down to locate them, and plug them with concrete. The expectation that the insertion of a couple of connecting rings would enable the sinking to be carried down to the coal measures without further trouble was not realized, a further leak in the concrete plug necessitating the flooding of the shaft to prevent the caving of the rock. The diver widened the breach to a width of 7 ft., height 1 ft., and depth 20 in., packed sandbags in front of the opening, and quickly kneaded in the cement, poured in with buckets. In a few days the cement had set hard enough to allow the shaft to be unwatered, and sinking continued to completion.

In putting down a new shaft at the Dutch State Colliery, Emma, the upcast pipe of the shaft pump broke, a length of over 200 yards of pipe falling down the shaft, and burying itself and the sinking pumps in the shaft bottom. A diver was sent down for several days in succession to ascertain the best places for progressively lowering the new sinking pumps, and eventually the shaft was cleared. Another instance of the utility of divers' work was afforded in a pit at Herne, Westphalia, where a shaft was being unwatered by means of water barrels, which operation was retarded by a bar connecting the on-setting device at the pit eye. This bar had to be partly unbolted and partly cut through by the diver, who also repaired and renewed the guides, and set up wire netting, 10 ft. in height, on both sides of the pit eye to prevent the water from floating anything down from the roads into the shaft.

In putting in a new winding rope at the De Wendel pit, the old rope, which was attached to the new one, broke and dragged the latter down the shaft, and at the same time completely destroying the tail rope. The whole of them fell into sump and stopped the pump at work there and the diver was engaged for nearly three weeks in clearing up the damage. Again, while the No. 11 shaft at the Ewald-Fortsetzung pit was in course of sinking, a sudden rush of water flooded the pump motor, and it was decided to install a centrifugal pump to work in 30 ft. of water so that no suction would be required even if the water level were lowered, the motor being mounted just below bank in order to guard against flooding in the future. With this object a diver was sent down to put up a pair of 10½ in iron girders across the 18 ft. shaft and bolt them to the flanges of the tubbing (Fig. 4). Two iron plates to carry the pump were secured to the girders, the suction pipe of the pump being led up between them. The vertical shaft of the pump was led up about 65 ft., inside the upcast pipe and guided by wooden bearings mounted between the pipe flanges. The upcast pipe was bent horizontally just below the motor, and was provided at the bend with a stuffing-box for the passage of the pump shaft. The pump was constructed to raise 660-gals. per minute against a head of 190 ft.

In the foregoing operations, wherever compressed air was available, the supply of air to the diver was taken direct from the air mains, thus dispensing with the troublesome work of pumping air. In several cases, mine officials who had studied diving operations during their mining-school course, rendered effective assistance to the diver; and it is therefore recommended that, in the case of pits where water troubles are frequent, some of the officials, overmen in particular, should occasionally practise working in diver's dress (on the same lines as the members of rescue corps exercise with breathing appliances) at some mining school where such instruction is given.

FOR THE PNEUMATIC COMPACTING OF CONCRETE

Reinforced concrete for building walls is commonly mixed quite wet and is usually compacted, by spading it. Concrete containing less water, and of a quaky rather than fluid consistency, is sometimes specified; but it can not

be economically tamped in thin reinforced walls. However, it can be compacted by striking the forms and the reinforcing bars with a light wooden maul. This suggests the possibility of using a pneumatic hammer for this purpose, for a large number of sharp, light raps should prove effective in causing the concrete to settle tightly in the forms.—*Engineering and Contracting.*

THE GLOBE-JOHNSON ROTARY AIR PUMP

Reciprocating air pumps when employed for the production of high vacua have their well known disadvantages and shortcomings, some, if not all, of which are avoided in the Globe-Johnston rotary valveless air pump here presented. It is offered to the public by the Globe Pneumatic Engineering Co., Ltd., 1 Victoria St., London, S. W. I.

Fig. 1 is a section of this pump and shows clearly its construction and action. It is applicable to every process where vacuum or low-pressure compressed air is required.

The minimum capacity for which the smallest size is built is about 20 cu. ft. per min., and the various sizes are graded upward so that the largest machines cover the highest capacities used in industrial processes. The speed of rotation ranges from about 3,000 r.p.m. for the smallest sizes down to about 1000 r.p.m. for the largest. The pump can operate with any type of condensing apparatus, and in connection with these plants will produce under favorable conditions a vacuum within one-half inch of the barometric reading.

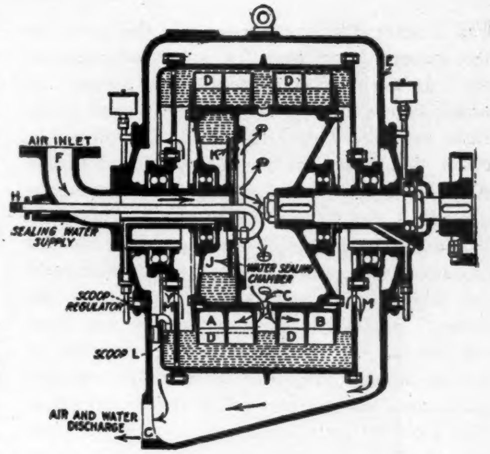


FIG. 1

As an air and gas compressor or blower, the machine is applicable to all processes where low-pressure air is required.

According to the *Steamship,* this rotary vacuum pump and compressor consists of two main parts, the rotor and the drum. These parts rotate on ball-bearings. The modification necessary to convert the vacuum pump into an air compressor is slight, but a reversal of certain component parts or of the direction of rotation is necessary. The difference in arrangement between vacuum pump and compressor will be seen on reference to Figs. 2 and 3. Its construction is shown in the accompanying illustrations.

The rotor, shown in Figs. 2 and 3, is a hollow member on the outer circumference of which deep double-thread screws are formed.

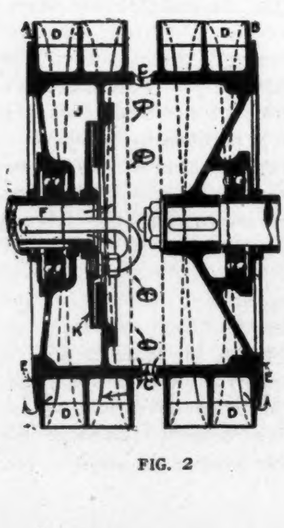


FIG. 2

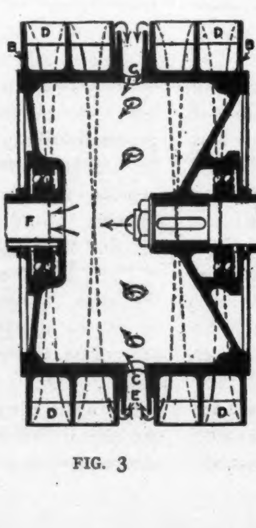


FIG. 3

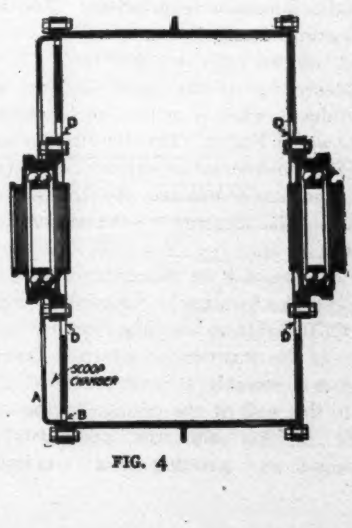


FIG. 4

Fig. 2 shows the arrangement of the rotor for the vacuum pump and Fig. 3 for the compressor. In the smaller machine these threads are single-handed only, but in the larger sizes right and left double threads are employed in order to obviate the possibility of end thrust. A passage C runs between the twin-screw threads *A* and *B* into the interior of the rotor. When the machine is producing a vacuum, this passage acts as the inlet to the screw threads, but when air is being compressed it is the outlet. Similarly, the pipe *F*, running from the interior of the rotor to the exterior of the machine, is the inlet pipe in the vacuum pump and the outlet pipe in the compressor. The screw threads are joined by a large number of narrow partitions, or blades, *D* which are equally spaced round the periphery of the rotor. The outer and inner edges of these blades are respectively flush with the top of the screw threads and halfway down the depth of the threads, Figs. 2 and 3.

The ring of water is, in the first place, set up by the action of these blades in conjunction with centrifugal force. Annular rings *E*, called shrouding plates, fitted to the sides of the rotor and reaching somewhat below the water level on the discharge side, prevent the exhausted or compressed air returning along the screws when the thread ends leave the water seal. The motor is coupled direct to the driving shaft.

The rotating drum, Fig. 4, is a hollow cylinder also running on ball bearings. The holes *D* in the side plates of the drum act as discharge and inlet openings for vacuum pump and compressor respectively. The drum, when rotating, contains the "ring of water" and is set eccentrically to the rotor. The relative eccentricity of the rotor and the water ring produces what is called the working space, as shown in Fig. 5. The net circular area of this space considered in conjunction with the pitch of the screw threads and the speed of rotation is the measure of the air capacity of the pump.

At one end of the drum a ring *A*, Fig. 4, is fitted, forming a channel communicating with the drum through the holes *B*. The scoop, the function of which is described later on, is a suitably formed piece of tubing fixed into the wall of the casing, having its working end dipping into the previously described channel and pointing in a direction opposite to that of the rotation of the drum. It is shown at *L*, Fig. 1. In vacuum pumps where the load is practically constant very little adjustment of this scoop is required, but means are provided for changing its position by hand. In air compressors this adjustment can be made automatic, and an effective means of adapting the output of air to varying demands is thus provided. As the demand is reduced and the pressure, in the receiver or pipe system tends to rise, the automatic control gear causes the scoop to lower the depth of the ring of water until compression ceases. In these circumstances the power consumption is reduced to about 15 per cent. of that required at full load, with a corresponding reduction in the running costs. As the pressure falls the scoop is automatically returned to its working position, whereupon the water rises to the required depth and compression begins again.

The casing *E*, Fig. 1, is a cast-iron or steel structure with the upper cover removable to facilitate examination or the dismantling of the machine. The rotor and drum rotate on ball bearings in this casing. The aperture *F* is the induction pipe, and the opening *G* the air and water discharge pipe in a vacuum pump. The casing and rotating parts form a self-contained unit which may be mounted on a bedplate, brackets, concrete or any other suitable foundation.

The essential feature of the pump is a rotating screw, set eccentric to and working in conjunction with a ring of water established and maintained by centrifugal force within a container called, in the following description, the "Drum." To put the machine into operation water is allowed to flow through the pipe *H*, Fig. 1, and the pump is set in motion. The water passes through the water-sealing chamber *J*, to the interior of the drum, which it gradually fills until it becomes deep enough to be caught by the partition blades *D* of the revolving screw rotors *A* and *B*. It is then whirled round the interior of the rotating drum *C* by these blades.

The friction between the whirling water and the drum causes the latter to revolve also, and in a very short time the drum and the rotor are running at practically the same speed. The sealing water continues to flow into the machine until a ring of water is formed within the drum sufficiently deep to submerge the screw threads on the rotor at the point where,

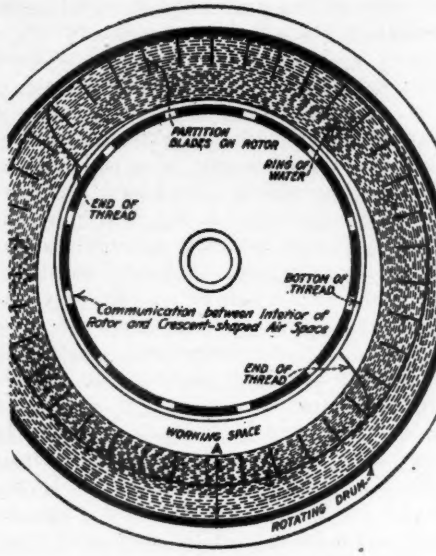


FIG. 5

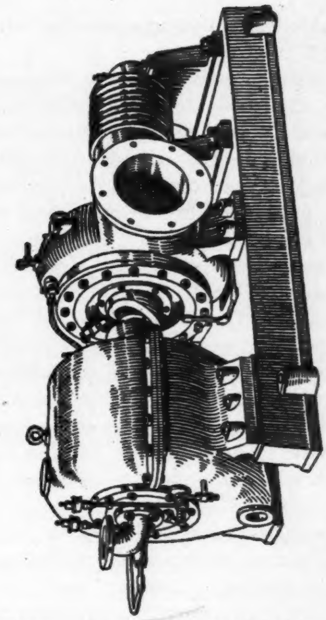


FIG. 6

owing to the eccentricity, they approach nearest to the inner periphery of the drum. It is this water, maintained in the form of a ring within the drum by centrifugal force operating in connection with the threaded rotor set eccentric to it, that produces the pumping effect. Immediately the ring of water has reached the proper depth, the pumping action begins. The position of the ring of water in relation to the rest of the rotating system is shown in Fig. 5. The friction referred to obviously ceases when the two parts have acquired the same speed.

The time occupied between the first revolution and the moment when pumping begins varies according to the size of the machine. With machines of the largest capacity it is only a matter of a few minutes.

During the operation of the pump a small stream of water flows continuously into the drum through the pipe *H*, Fig. 1, and in order to maintain the correct depth in the ring of water, a scoop L is fitted. The scoop skims off the surplus water, and this function is continuous while the pump is working. The water may be conducted from the scoop back to the supply tank and be used over and over after being cooled.

The water seal is merely a substitute for stuffing-box. It consists of a fixed disk *K*, Fig. 1, around which a chamber containing water rotates. An equal water level on each side of the disk is maintained by the centrifugal force in the water. If, however, atmospheric or other pressures exists on one side of the disk and not on the other, it is obvious that this level will be disturbed and the water will rise higher on the side opposite to that on which the pressure is exerted. A new point of balance will thus be found wherein the combined pressure and centrifugal effect on the one side will be equal to the centrifugal effect alone on the other. If at this point the periphery of the disk is sufficiently submerged, it is clear that no leakage of air can take place from one side to the other. Being so arranged as to receive automatically a continuous supply of water, the water seal requires no attention to keep it tight.

EXTINGUISHING FIRES OF GASOLINE OR OTHER LIQUIDS*

BY GEORGE A. BURRELL

There are two principal methods of extinguishing burning liquids, as follows

1. To form a blanket of gas or solid material over the burning liquid and cut off the air-supply.

2. To dilute the burning liquid with a non-

*From Technical Paper No. 127, U. S. Bureau of Mines.

inflammable extinguishing agent that will mix with it.

Water may be used for extinguishing burning liquids, such as denatured alcohol, wood alcohol, and acetone, that are miscible with it. If such a liquid as gasoline, which is not miscible with water, catches fire, the application of water produces little or no effect except to spread the burning liquid, and thus scatter the fire over a larger area. However, the application of a large quantity of water to a small quantity of burning oil, by its cooling effect, may aid in extinguishing the fire.

Of materials used to form a blanket of gas or solid material over burning liquid, thus cutting off the oxygen supply, several are in common use. These include sawdust, sand, carbon tetrachloride, and the so-called foam or frothy mixtures.

The efficiency of sawdust is due to its floating for a time on the liquid and excluding the oxygen of the air. Sawdust itself is not easily ignitible, and when it does ignite burns without flame. The character of sawdust and its moisture content is of little or no importance. For extinguishing small fires, when just started, it may be applied by means of long-handled wooden shovels.

Sand probably serves about as well as sawdust for extinguishing fires on the ground, but is heavier and more awkward to handle. When thrown on a burning tank it sinks, whereas sawdust floats.

Carbon tetrachloride, the basis of various chemical fire-extinguishers, if thrown on a fire forms a heavy non-inflammable vapor over the liquid, and mixes readily with oils, waxes, japan, etc. The vapor is about five times as heavy as air. When thrown on a fire, it produces black smoke, the hue of which is caused by unconsumed particles of carbon. Pungent gases are also produced, probably hydrochloric acid gas and small volumes of chlorine gas. Although the fumes are pungent, brief exposure to them does not cause permanent injury.

The efficacy of carbon tetrachloride depends largely on the skill of the user. If liquid in a tank is on fire, the height of the liquids is important. When the liquid is low, the sides of the tank form a wall which retains the vapor, but when a tank is nearly full of a highly volatile liquid like gasoline, only the most skilled operator can extinguish the fire.

For smothering some small fires of burning gasoline an ordinary blanket may be used.

Methods depending on the use of foam or frothy-liquid mixtures to extinguish fires in large gasoline storage tanks originated in Germany. For such an extinguisher two liquids are caused to mix in a tank, whereupon foam is produced. The tank is made air-tight and sufficiently strong to permit the foam to be forced out under pressure of a gas (carbon dioxide) simultaneously generated. The frothy mixture owes its efficacy to its blanketing action in excluding air from the fire. It is stiff and shrinks only slightly in volume even after half an hour. In one installation, water, bicarbonate of soda, and soap-bark are used in one tank, and acid in another tank. A fusible link, which will melt at 212°F., releases a hammer, which breaks the glass tank containing the acid. The released acid is led through two perforated pipes into the solution, producing a violent ebullition of foam, which finds its way into the tank of burning oil.

COOLING, DRYING AND PURIFYING AIR*

BY W. J. BALDWIN

The necessity for removing dust and other impurities from the air needs no amplifictaion from me, as we all recognize the advantages of pure air and nearly all strive in every way to obtain it.

WHAT IS PURE AIR?

The ordinary meaning of the term pure air, however, should be amplified, and when it appears in a contract it should mean more than that the air should not be fouled by the human breath and by exhalations from the human body. The engineer must not be content when making an examination within an enclosed structure simply to report that the air is maintained at some common standard of purity of contamination, expressed by the number of times the CO_2 within the room is in excess of the standard, good or bad, found to exist outside the enclosure. Such a standard gives only an approximate idea of the condition of the air within the enclosed space, and it is the roughest approximation under the common acceptance of the term.

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*American Society of Mechanical Engineers, New York meeting, Dec., 1917.

Presumably there is no pure air near the surface of the ground, nor in the atmosphere of cities. The best we have exists at the tops of mountains, or on the ocean, but even this we are unable to standardize.

Air with about two parts of CO_2 in 10,000 is considered good, no matter where we find it; but in cities where much coal is burned the proportion is higher, and may rise to as high as 10 parts of CO_2 in 10,000. An increase from 2 to 4 parts in 10,000 for enclosed spaces above the outside conditions has been considered good, even for schools and hospitals, and very good for workshops.

DRYING AIR

These conditions, however, do not comprise the whole problem. Further effort should be directed toward drying air by some simple mechanical process. In attempting to free air from an excess of humidity, which is often as much of an impurity as are the other forms of contamination, I have the following data to offer:

About two years ago I worked to perfect an apparatus that could be put in the porthole or the dead light of a ship and would exclude the rain or spray, while freely admitting large quantities of air to the cabin of the ship, without admitting the water. This led to freeing the air of an excess of humidity.

The experiments conducted with the preliminary apparatus for excluding rain or spray while freely admitting the air as in the case of a ship rolling heavily at sea, suggested the possibility of removing the excess of humidity in the air, particularly with a view to admitting air to the radio room of a ship, and not only exclude the rain and the spray but also regulating the humidity, so as to keep the air at *some common standard of saturation* as far as humidity was concerned. The purpose was to overcome a difficulty with the attuning apparatus of the receiving and sending instruments, either at sea or in the higher atmosphere.

This led to the design of an apparatus for a radio room on the lines already set forth, that would admit air not only separated from rain, salt spray and spume, but that would also condition or regulate the humidity within the room by keeping it at a common standard of humidity, regardless of the outside changes.

Cold water in the spray form will do this provided the spray can be gotten rid of after

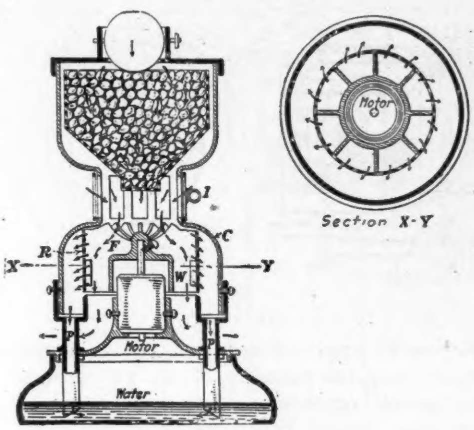


FIG. I

it has combined with the excess of humidity (steam in the air) and then separated from the air by some practicable form of apparatus that is simple, and that occupies small space.

While a shower of rain will clear the atmosphere, the elements of nature have all outdoors in which to set up the apparatus for such a result. The cabin of a ship or a radio cabinet is infinitely small in comparison with all outdoors, yet a similar result can be achieved in a space as small as a cabin or radio cabinet.

To accomplish this I used a cold-water spray apparatus similar to one I had designed two years earlier for the purpose of precipitating the CO_2 when found in great excess in a confined space, as in the hold of a submarine, when forced to stay a long time under water.

In this machine a spray of potash water was used in connection with a mechanical dust precipitator for the purpose of seizing on the carbonic acid in the air and throwing it down so as to eliminate the CO_2 at the dust and water discharge of the apparatus.

It was proposed to put the apparatus in a bulkhead; the discharge side of the apparatus coming into the air of the living quarters, the air freed of its CO_2 being forced backward again into the chamber of greatest vitiation, thus forming a cycle.

In the general experiments it was found that a prepared spray of chemical liquid or even cold water not only seized on the dust but on other gases in the air, with which the chemical in the spray would combine, and that a

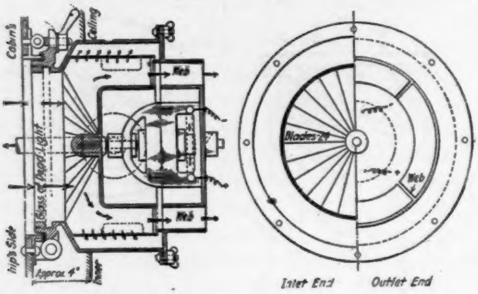


FIG. 2

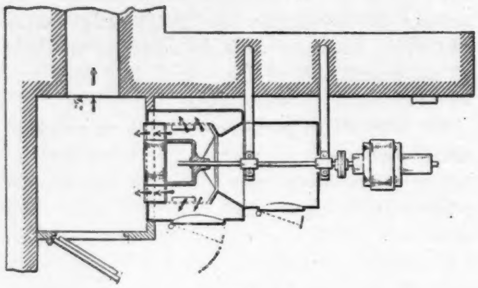


FIG. 3

pure-water spray turned into the apparatus would keep the humidity of the air constant by suitable regulation of the temperature of the water spray. In a room at 90 deg. fahr. and a humidity of almost 90 per cent. we could drop the humidity to 45 per cent. by reducing the temperature of the spray to 70 deg. fahr.

A simple form of the apparatus arranged for cooling a room is shown in Fig. 1. The apparatus from the inlet to the line *X-Y* is an ordinary fan or blower *F*, and the downward extensions of the fan blades or wings *W* are necessary to accelerate the rotary motion of the air.

The rotor *R* is a rotating hoop of permeable metal, against the inner side of which the air is thrown with all its impurities. If the heavy particles in the air, such as dust, mud or particles of water, strike into the perforations of the hoop, they pass through into a quiet space formed by the outer case *C*, Or, if they strike on the solid part of the hoop, they are rubbed through the nearest holes by the forward movement of the air. They then pass into the quiet space *C*, drop down within it, and escape by the pipe or pipes *P* into the tank.

The air does not escape with the heavy particles, as might appear at first, for the lower ends of the pipe legs are sealed by the water in the tank. The tank may be of any shape, or there may be no tank, the separated particles going to a waste pipe.

The greater the velocity of the rotor *R* the more efficient is the apparatus. A speed of 5,000 ft. per min. is very practicable, but 10,000 is not excessive, either from the point of bursting or for any other reason.

The fan gives the same static pressure as any other centrifugal blower of equal diameter and speed and requires only equal power for equal work, and the power required for separation and friction is considerably under 25 per cent. of the blower power required to move the air.

The device as described above illustrates the principle of the various types of apparatus, whether used for taking the dust from the air, the CO_2 from a chimney or an enclosed space, the excess of humidity from the air, throwing down fog, cooling and moving air, etc. It will be noted that the ice in the upper tank serves both as a cooling medium and for the supply of cold water, broken into spray by the rapid motion of the fan, for the purification of the air.

In Fig. 2 is shown a type of the apparatus as developed for use in the porthole of a ship, and in Fig. 3 a horizontal design for the removal of dust particles from the gases of combustion in a chimney.

MEASURING AIR DELIVERY OF TURBO BLOWER

BY THOMAS G. ESTEP, JR.

When the reciprocating type of compressor is used for furnishing air for blast furnaces, no devices are absolutely necessary for measuring the volume of air delivered. All that is necessary in order to obtain a close approximation of the quantity of air is the displacement of the compressor and the volumetric efficiency. The latter factor is an uncertain one, depending upon the clearance of the compressor, the ratio of compression to supply pressure and the leakage through valves and around the piston. The volumetric efficiency can, however, be estimated very closely and the volume of air delivered by the compressor can be determined accurately enough for all practical purposes. Even if any of

the various measuring devices were used in connection with reciprocating compressors, the results would be in error, due to the pulsations in the flow.

The advent of the turbo blower for furnishing air for blast furnaces has presented a new problem to engineers. It is very essential that the volume of air delivered to the furnace be known at all times and it is even desirable that a continuous record of this quantity be obtained so that a comparative study of the furnace operation can be made.

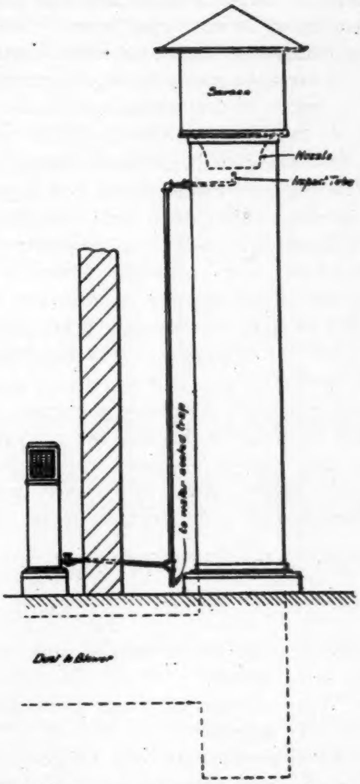
The blower itself does not give any means of making this determination as does the displacement compressor so that some other means must be employed. Due to the fact that the turbo blower produces a steady flow, any of the approved methods of measuring gases can be used, the only question being to select the most suitable, accuracy and simplicity being the predominating features.

A pitot tube placed in the intake pipe would at once suggest itself as being a simple and accurate means of measuring the volume of air, and such installations have been made which are giving uniformly satisfactory results. There are, however, certain factors which must be taken into consideration before such an installation will give reasonably accurate results.

The intake pipe is usually made up of riveted steel plates of which the internal diameter may not be uniform. The ring seams may cause eddy currents which would influence the flow, and in certain cases the intake pipe may be so short that the flow does not become uniform before being measured.

If the intake pipe is long enough and the diameter accurately determined at the point of insertion of the pitot tube, and then a traverse of the pipe is made so that the tube can be placed at a point which will indicate average velocity, the quantity of air flowing will be determined accurately enough for all practical purposes.

The most satisfactory installation seems to be a combiantion of a standard orifice and a pitot tube. The standard orifice can be placed in the end of the intake pipe, directly under the hood and the pitot tube used to measure the velocity of the air leaving the orifice. Aside from the great accuracy of such an installation, which is of first importance, it has the following advantages:



Showing arrangement of air intake, nozzle impact tube and recording instrument.

Practically no changes are required in the intake pipe. The hood may have to be raised a little in order to install the screen and to give a free inlet to the orifice. Some tests made at the laboratories of the Carnegie Institute of Technology showed that if the hood was at least one-fourth the diameter of the pipe away from the orifice it would have no influence on the flow.

The orifice being located in the end of the pipe, the velocity of approach is zero, which means that the chart of the recording mechanism is more easily constructed. If the orifice were placed somewhere in the pipe, it would be necessary to take into consideration the velocity of approach which is an added complication to the calculation of the quantity flowing.

With the orifice located in the end of the pipe, static pressure determinations are not necessary, so that the pitot tube in reality

becomes a simple impact tube with just one connection to the recording device. This eliminates entirely the much-discussed question of how to measure static pressure correctly.

The length of the intake pipe has no influence on the measurements.

If the orifice diameter bears the proper relation to the pipe diameter, the loss in pressure is negligible. The orifice itself converts a certain amount of pressure into velocity and then, as the fluid issues from the orifice, a transformation from velocity to pressure begins, but due to eddy currents which are produced, not all of the velocity is converted into pressure again.

It is impossible to derive a correct mathematical formula for this loss, but a great many years ago, Carnot proposed an equation for this loss which checks very closely with experimental data. The formula is as follows:

$$\text{Lost head} = \frac{(V_2 - V_1)^2}{2g}$$

Where V_1 = velocity of fluid in pipe, feet per second.
V_2 = velocity of fluid in orifice, feet second.
g = acceleration due to gravity, feet per second.

The lost head is in feet of the fluid being measured.

Tests were made at the laboratories of the Carnegie Institute of Technology which showed that this equation will give fairly close results. When the velocities are low, the calculated loss is too high and when the velocities are high, the equation gives results too low. Over the range of velocities used in the tests, the variation of the actual and calculated loss did not exceed 7 per cent.

If an orifice diameter of about six-tenths of the pipe diameter is used and the lost head reduced to actual additional horsepower required to drive the turbo-blower, we find that it amounts to less than one-half of one per cent., which is certainly allowable.

Several installations of this kind have been made by the Bacharach Industrial Instrument Company, of Pittsburgh, and are giving excellent satisfaction.—*Blast Furnace and Steel Plant.*

RALLY THE ENGINEERS*

Rally all the engineers, we've got big work to do.
We've got to push the Kaiser out and all of his damned crew.
We've got to clean up Potsdam before we're really through.
But we'll keep pushing together.

Hurrah! Hurrah! Our fight is over here.
Hurrah! Hurrah! It's up to the engineer.
We've got to get munitions out and keep the ocean clear
And help rid the world of the Kaiser.

We must rouse the country from its woeful lethargy,
Its habit of expecting that to-morrow we may see
The smashing of the German line by armies o'er the sea,
Or leaving Georgie to do it.

CHORUS.

The engineer will put the pep into the workers' ranks.
He'll not stand long for shirking or the other Hun-like pranks.
He'll throw his slide rule far away before condoning cranks
And down profiteering altogether.

CHORUS.

When the call of peace doth come, the engineer must rule.
He knows the fellow at the top and Tony at the stool.
His judgment of humanity he's learned at life's own school
And he'll bring everyone together.

Hurrah! Hurrah! Our fight is over here.
Hurrah! Hurrah! It's up to the engineer.
We've got to get munitions out and keep the ocean clear
And help rid the world of the Kaiser.

The opening of a new railroad to provide an outlet for the product has led to the dynamiting of one of Switzerland's most famous glaciers and the marketing of the ice.

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*Sung at the Annual Meeting of the American Society of Mechanical Engineers, New York, Dec., 1917.

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CONTENTS

THE NEW YEAR AND THE WORLD WAR

To-day we turn a leaf of Life's great book.
The story the fresh opened page shall tell,
Is ours to write for distant age to read
And understand; for only day by day
Ken we our task, and little hint have we
Of the completed plan. We only know
Our way lies straight ahead, with upward trend,
But no smooth resting place, and no let up
For slackness or fatigue.

God's will be done;
Determinedly, inspiredly, we speak,
And not supinely or resignedly.
For upon us it's laid that will to do.

Most thankful must we be that we're not cursed
With long foresight; for were we so equipped
How had we faced the horror crowded years
Just left behind, or how, full confident,
Still dare the gruesome shades and dreads unknown
Which frown so close before?

To reassure
And brace us for the struggle grim which waits.
We need but look far back along the years
And note where vict'ry lodged, and where defeat.
It is no losing fight that Man has fought,
Nor are we listed to be worsted now,
And never held we surer vantage ground.

The game of frightfulness is nothing new;
And if so be Man's foes shall do their worst,
'Tis what they've always done, but now, full grown,
With insane hate and fiendish cunning crammed,
They strike a fiercer blow; mayhap their last.

The ways of war have been transformed, its reach
Extended, so that not alone on land
And o'er the widespread seas, but in the sky
And 'neath the wave destruction rages wild,
With unrelenting potency of hate;
And for the time eluding all restraint

It seemes a change has come to all our ways;
The keynote now is contrariety;
Long years of peace have forged new tools of war,
And now through war we seek the means of peace.

When vict'ry comes, as sure it must ere long,
Not easy will it be to say by whom,
Or when or where was blow decisive struck.

We're all enlisted for the war, and we
Have each some thing that we at least can do
To hasten the result. No warlike garb
May be for us, nor may we face the guns
Or thrust the bayonet, or have our hand
In wholesale butchery, or see brave men
In crowds mowed down.

Our fighters must be fed
And clothed, and swiftly moved from place to place,
And kept supplied to prodigally waste
Hell's fires when the decisive moments come;
And they must surely know that they are backed
Unfailingly by love and trust at home.

How tame is it to prate of duty now.

THE ENGINEERS NOW ALL UNITED

We print here in full the address of W. L. Saunders, "Speaker at Large," on Friday evening, Dec. 7, 1917, in the Auditorium of The Engineering Societies Building, New York, at the ceremonies welcoming the American Society of Civil Engineers into the Fraternity and Habitat of the Founder Societies

Permit me, Mr. President, and ladies and gentlemen, to answer the question, Why I am "at large" at this time? The answer is very simple. I am one of the committee which has had the program of this affair in charge. Mr. Dunn is another. He called me one and I called him another, so in the interest of harmony it was decided to parcel the honors and punish the audience.

As we stand on this Scotch preserve, upon which has been reared this splendid menagerie, we naturally think of the great game-keeper, Carnegie,who made it possible. We are also reminded in the variety of the performance to-night of the party of hunters who, standing at the gate of a Scotch game preserve, said to the keeper, "Have you all kinds of animals here,—any deer?" "Hundreds of them," was the reply. "Any rabbits?" Thousands of them." "Any gorillas?" "Well," said the old Scotchman, "they cum, just like yoursel, now and then."

And so on this occasion you have seen the gentle polish, you have heard the soft and never still voice of the electrical engineer; you have heard the gear-like meshing and the turbine wheeze of the mechanical, tempered by the eloquent tones of the miner, who being also reared in things chemical and metallurgical seems to cry out to our new found friends:

O, come where the cyanides silently flow,
And the carbonates droop o'er the oxides below,
Where the voice of potassium is heard on the hill,
And the song of the silicate never is still.

Come, O come,
And batter the drum
Of boilers and amperes and uranium.

Verily this is indeed a rare occasion! You, Mr. Chairman, to-night are not alone the President of this United Engineering Society, but also of the Society of Illuminating Engineers. Many prophets and kings have longed to see the things that we see and did not see them, but are happily laid where they cannot hear the things that you hear to-night. Think of a full fledged member of the American Society of Civil Engineers, that proud old professional peacock, walking in the same alley with a fellow who calls himself a Mining Engineer, but who never could define it! Truly the lion and the lamb now lie down together, but let us take care that we do not repeat the experience of the circus where a lion and a lamb were exhibited in the same cage, an exhibit made possible only by renewing the lamb at frequent intervals.

Let us hope that the union which we celebrate to-night is not merely a physical contact, but that it represents the spirit and purpose of engineers to get together for service, a service not alone in scientific fields, but on the broader plains of civic life.

Let me tell you a true story of recent events at Washington. One of the most important laws which a Congress ever enacted is the draft law. This law wisely created District Boards for the purpose of determining exemptions. This is the Court of Appeals, the court of last resort, except the President. Each State and territory has one or more district boards. Now as this war is not only a clash of armies, but a combat between industries, it seemed plain that there were many men engaged in industrial work who might render greater service at home than in the

trenches abroad, so the advisers of the President succeeded in placing an engineer upon the proposed lists of members of each district board in each State in the Union. On these lists were representatives of the farmers, the legal profession, business men and representatives of labor. Here was the true position for the engineer, the man who is responsible for the creation and operation of our industries. The engineer members were selected from the organization of engineers which had been created by the Naval Consulting Board in each State and territory and through which the industrial plants had been surveyed and listed for war service. The President acting in harmony with our system of government, a government by states, sent these lists to the State governors, asking them to revise them and make such changes in the names as each Governor might deem wise. When the lists were returned to the President more than 90 per cent. of the engineers were scratched off to give place to lawyers and others.

It is useless for us to fume and protest at such incidents as this. It serves us right. We are not organized for civic service. We are not organized for any service. Our institutes, societies, and our engineering council suffer too much from professional megalomania. Such organizations as we have are not framed to suit the kind of government which we live under—a federation of states, counties and wards—a democracy.

Let us hope that we begin to-night by placing the corner stone of a structure to be reared on the lines of engineering democracy. Let us get together, not in high places only, not in the branches, but at the roots of the tree; not alone in scientific fields, but as technical men doing work as citizens, reaching into every village and every ward—a "Technical, Civic Federation." Let us organize; for in organization there is the essence of strength, the basis of influence and the opportunity for power.

FOR AVIATION WORK

The belief may be said to be now universal that aviators are to win the world war, or at least to be the most important agency leading to the final decision. The actual operators of the machines, the heroes of the sky, each represent a considerable number of skilled and responsible men working on the ground for the equipment and maintenance of his apparatus, and without all this service he would be paralyzed and useless. The mental and physical equipment of the qualified aviator must be exceptional, and only a small percentage taken from the average of men could ever be successful flyers, but in the work of building, repairing, adjusting and caring for the machines a great variety of special skill is required, and all good workers and mechanicians can be of service for some detail of the work.

For the further extension of the aviation branch of the United States Navy, Secretary Daniels has authohrized the enlistment of 8,000 young men, and in doing so has opened up most attractive opportunities in this new and unusually appealing service. There is an important and immediate need for mechanicians for naval aviation for the ratings of machinists' mates, carpenters' mates, quartermasters, coppersmiths and blacksmiths. These men will not be enlisted for pilot's duties but coming into the service with a general mechanical turn and a liking for the work they will receive a special and unusual training for the building, handling, repairing and overhauling of the navy's air craft. Succeeding in this they will be used as the ground personnel of the flying corps.

The requirements for enrollment will be the same as those for the regular service of the United States Navy. Training for machinists' mates and quartermasters will last about three months. Carpenters' mates will train for approximately six weeks. On completion of training course the provisional landsmen, after examination, will be rated first or second class petty officers on the basis of examination and all around ability. After getting a rating they will be eligible for promotion to the next higher grade if they show fitness and pass the necessary examination. Promotion in the aviation field is unusually fast. The age limit for this enlistment is 21 to 35 years, and each candidate will receive the U. S. Navy physical examination and not that required for flight duties. Men enlisting for aviation duty but failing to qualify will, if recommended by their commanding officers, be assigned to general service.

The following trades are covered by the ratings: Carpenters, wood-workers, machinists, coppersmiths, blacksmiths, fabric workers,

riggers, acetyline welders, gas engine overhaul men, and instrument makers. Requirements for the various classes of landsmen to be enlisted are:

Landsmen for Quartermaster; although no previous trade experience is required a general manual ability is required. Men of trades such as rigging, fabric working and wire working are desired, as are also men experienced in the operation of hydrogen plants or in the care and upkeep of dirigibles or balloons. Men in this training who display proficiency on dirigible work will be assigned to this branch. These men will also be used as sea-plane riggers, for general structure and overhauling and also inspection of dirigibles preliminary to flight.

Carpenters' mates will look after the upkeep and repair of wings, pontoons, flying boat hulls and bodies, balloons, and dirigibles, their training covering the practical application of their trade skill and general aviation work.

Machinists' mates will show previous experience in gasoline engines or any allied skilled trade such as that of electrician. These will be charged with the upkeep and overhaul of aircraft engines. Their training covers a practical understanding of aircraft engines.

Provision is made for men especially well qualified for enlistment or enrollment as carpenters' and machinists' mates to be enrolled directly for that second class rate should their skill be sufficient. The rating badge for men in this service will be the same as the regular except for the addition of double wings.

Applications and inquiries may be addressed to U. S. Navy Recruiting Bureau, 318 West 39th Street, New York, N. Y.

THE AIRPLANE AND THE WAR

While the hopes of the world are centered upon the airplane as the agency above all others by which to conquer peace and world-safety it is still the younger of the great modern war devices, the submarine having attained some phase of practicability many years before it. In the history of the development of the airplane three names, all American, stood out most prominently: Langley, Wright, Curtis. Langley did much in experimenting and in preliminarily determining the essentials for successful flight, but he was, in a way, before his time, as the most needed motor was not yet perfected. Wright also contributed much to the success of the machine and gave the world confidence by actual flight, but it is still to be said that Glenn H. Curtiss has done more to develop the practical side of aviation than any other man. To him must be given the credit of having trained more men and built more airplanes than any other individual in the world to-day, and yet it is to be remembered that he is under forty years of age.

After the declaration of war he put nearly all his time and resources at the disposal of the Government. His vast experience and his knowledge of the art has made his counsel most valuable.

It is therefore a most notable and a most commendable thing which *The American Machinist* has done in presenting in its fortieth anniversary issue a personal interview with Mr. Curtiss on the subject of airplane development, and its effect in the present world-conflict.

DECIDING FEATURE OF THE WAR

"From conversations which I have had, says Mr. Curtiss, with military men who are familiar with conditions on the western front and from the published reports which I have read of recent advances made by the Allied forces, I believe if any one element can decide this war, that element will be the airplane.

"Success in trench fighting to-day is largely dependent on artillery superiority. The army which succeeds in pouring into the opposing trenches a sufficient amount of steel has a comparatively easy time of it when the infantry is moved forward. In some instances an entire divisional staff has been wiped out by a properly placed sixteen-inch shell—a shell directed by airplane. Heavy artillery is of little use unless it can be properly directed, and, for this reason, with the wider use of this type of ordnance, the necessity for airplane observation has been greatly intensified.

"Since the failure of the Zeppelin raids in England, Germany, it is understood, has been making feverish preparation to enlarge her air force by building great numbers of speedy airplanes. News which I have had from our men in London indicate that the Germans are employing these machines for 'moonlight' raids over England and for general patrol duty.

"While I believe it is generally allowed that the Allies have won supremacy on the western front, yet, to keep it and destroy the Ger-

man submarine bases, and successfully prevent night bombing expeditions, faster and larger airplanes will be required. France and Great Britain cannot materially increase their aircraft production at the present time, and it is for this reason that they look to us in this emergency.

"The question of obtaining the proper machines is not, however, the only big problem, but how to get men to man them efficiently is an equally difficult task.

"The present plan for training aviators encounters a special difficulty. That is the lack of pilot instructors accustomed to fly the speedy fighting craft. There is no one to blame for this, as the United States up to this time has not needed men possessed of this special expertness. There is a problem, however, that the Government is successfully working out, and it should not be long before we shall be able, with the help of the experienced French and British airmen, to furnish a number of expert pilots, trained in America and flying American-made machines.

TYPES OF AIRPLANES

"As to the type of planes which will be used to finish the war, I do not believe our possession of air mastery will be secured by the use of any particular size or type of airplane. All types will be needed: Flying boats for coast patrol and submarine hunting; small, speedy machines for combat work and scouting; large and powerful machines for raiding and trench bombing, and probably several types will be developed to take care of various other exigencies as they arise.

"In fact, the range is as extreme as that in the navy from torpedo boat destroyers to super-dreadnaughts. The discussion about particular types of aircraft is the same as that through which the navy passed. With a swing of the pendulum, some favored the torpedo boat almost to the exclusion of other craft; others demanded that only big-gun battleships be built. Just as an efficient navy does not consist of all big battleships, or of all submarines or all light cruisers, neither can an efficient air-service consist of only one type of plane, however successful its performance for its particular design or purpose.

"Actual fighting between men in the trenches and airplanes equipped with machine guns has been reported. Possibly a special type of machine will have to be designed for this purpose before the war is over.

"The Germans are wonderful refiners and exceedingly clever adapters. They very quickly copy French and English machines whenever they fall behind their lines, and in many cases make improvements. They will, of course, do this with the American machines. Germans, however, have shown little real inventiveness during the war, and for this reason I believe we can keep ahead of them.

"No one need doubt the ability of the American aeronautical engineers to produce craft which will be more powerful and speedier than any which have been used abroad. Best of all, we have the material and factory facilities for turning out a vast quantity of machines of any kind that may be required for use by the Allies or ourselves.

"The Government, through its many branches, has made wonderful progress in air work, and these French and English engineers with whom I have talked seem to be more than satisfied with the result of our efforts thus far.

"While I cannot, due to the Government censorship, tell much about the details of the newer type of airplanes, hydro-airplanes and flying boats, I can, without violating confidences, say that we are developing machines to-day that will be superior to anything now in use in Europe, and these in sufficient quantities to meet the demands of the program that is contemplated by the War Department."

RAISING A QUARRY REGIMENT

The Engineer Corps of the U. S. Army has been authorized to raise, by voluntary enlistment, a Special Quarry Regiment to consist of six companies of 250 men each, and to be known as the 28th Engineers, National Army. This regiment is now being recruited, and the first two companies are in training at Camp Meade, Md.

The regiment is to be made up entirely of picked men from the various quarries of the country. All trades and occupations in the quarry business will be represented. Each company will have a sufficient number of skilled men to operate a separate quarry plant.

Each company will be equipped with a complete rock-crushing and screening plant, capable of producing 1,000 tons of crushed rock per day. Churn and air-drilling outfits will be provided, and the equipment will include steam shovels, locomotive cranes, steam locomotives, cars and other standard quarrying machinery. Only men who have had experi-

ence in the handling of such equipment and those who have worked in and about quarries will be enlisted for this service.

The commanding officer will be a Regular Army Officer, the other officers of the Regiment being largely drawn from the Engineers and Quarry Superintendents who have volunteered their services, have been given the necessary military training at the Officers' Training Camps and are now commissioned in the Engineer Officers' Reserve Corps.

All men who volunteer for this service will be enlisted as privates, but those who show themselves qualified will be raised to the grade of non-commissioned officer. Any recruiting officer will enlist men for this regiment, but each man must show proper qualifications by way of experience and pass the usual physical examination. All men between the ages of 18 and 41 are eligible for enlistment if not actually drawn on the draft.

More detailed information will be furnished by Major O. B. Perry, of the Chief Engineer's Office, Washington, D. C.

A CANARY'S FATAL SONG

Our readers who are well informed as to the use of canaries and mice by miners to give warning of the presence of carbon monoxide, will readily understand and appreciate the following from a recent issue of *The Official Bulletin*:

For more than a month on a northern sector of the line the British had been secretly mining beneath the German trenches. The work was almost complete. During the operations several canary birds were, as usual, kept in the excavation to warn the workers of the presence of fire-damp,[?] which is fatal to the birds. One little songster, however, escaped from its job, flew into the middle of "No Man's Land" and, alighting on a bush, began to sing. Consternation reigned in the British lines. If a bird should be discovered by the Germans the work of weeks would go for naught, as the enemy could easily interpret the meaning of its presence and prepare to combat the sapping operations. The infantry was immediately ordered to open fire on the canary to destroy it. But it seemed to bear a charmed life. Even the sharpshooters failed to bring it down as it hopped from twig to twig. Finally the artillery had to be called on. A trench gun with a well-timed shell blew the bird and the bush and the song into nothingness.

THE GRANITE NATIONS

France, Britain and the United States have enormous interests on this continent, and they are united interests. I have always felt, Mr. President, in dealing with rocks and geology, that these three nations are the granite nations of the world. Granite, the most durable and the strongest of all rocks, combines three essential constituents, mica, quartz, and feldspar. To me, mica represents the French element of that rock, polished, smooth, shiny. Then comes the British, the quartz, so durable, lasting, resisting, typifying in a sense the British who came next as settlers on this continent; and then the feldspar, a useful and essential and also a composite mineral, which typifies also in other respects the United States. There we have the granite, the mica, the quartz, and the feldspar, each one in its own way useful and in every way necessary singly and separately, but together forming the strongest rock, typifying the nations to which we look forward to help bring peace and to form that peace league of nations which will endure forever.—*Dr. Henry M. Arni, of the British Legation, before A. I. M. E., St. Louis.*

CEMENT GUN ON OLD STONE MASONRY

About the first recorded instance of the use of Portland cement in American railway structures was the covering of old stone masonry culverts on the Erie Railroad with concrete. The frequent repointing of stone is alone sufficient justification for covering it with a cement mortar slab, in many cases; but when the stone is of a character that slowly disintegrates by "weathering," there is only one ultimate solution of the problem, namely surfacing with cement mortar or concrete. Recently a rubble arch bridge near Lancaster, Pa., was surfaced with cement mortar applied with a cement gun. The bridge was built more than a century ago, and had disintegrated badly. Loose mortar was picked out of the joints and wire mesh was fastened to the face of the masonry with boat spikes driven into the joints. Then a 1:3 mortar was shot on, covering the surface to a thickness of 2 in. The Dewey Cement-Gun Con-

struction Co., of Allentown, Pa., covered 11,-000 sq. ft. in 14 days of work with the "gun," or 800 sq. ft. per day.

DESTROYING WORKS IN OCCUPIED TERRITORY

A Reuter's Agency's report, based on a competent Belgian source, states that the Germans are finishing the destruction of works in the Liége district. Gangs of men have been put on to destroy the Cockerill blast furnaces. Besides this, all the machinery has been taken away as well as all raw materials and stocks, and the central works are being taken to pieces in order to remove all the copper from them. At Ougrée preparations have been made to pull down three blast furnaces; two are already destroyed. Seven rolling mills out of nine have been removed. At Angleur everything has disappeared. At Grivegnée everything has gone except the steel works, where the Germans are making ingots. At the Espérance works at Longdoz as soon as the first requisition papers arrived the Germans immediately began to destroy or to take away the objects mentioned, namely, blast furnaces, steel works, rolling mills, foundry, and machine shops. Everywhere also the Germans are taking away the papers and plans from the drawing offices. The situation is more or less the same all over the country. The important works of "La Providence" at Haumont (Hainaut) have been completely destroyed, as well as the power station of the same firm at Marchienne.

NOTES

The present war is producing many improved therapeutic and surgical methods that have accounted for saving the lives of thousands of wounded soldiers. Mention has recently been made in English papers of the use of electrically heated beds for men who are so desperately wounded that they were almost on the verge of death. Numerous such cases have been revived in this manner. Electric heating elements are woven into the mattress and blankets of special hospital beds.

Power boats are now near the 60 miles an hour mark. A recent record is an average of 56 miles an hour over a thirty mile course, the first six mile lap being covered at 59.5 miles per hour.

In one of the big motion picture studios in New Jersey they have a great theatrical stage mounted on a turntable so that it can be made to face the sun, or vice versa, at all hours, and thus control the shadows.

The United States Lighthouse Service is charged with the maintenance of aids to navigation along 47,192 miles of coast line and river channel. There are employed 5,796 persons, including 122 technical force, 149 clerical force, and 5,525 employees connected with depots, lighthouses and vessels.

The coefficient of friction of solid rubber tires on cement and vitrified brick roads is about 0.6, while that of pneumatic tires under similar conditions is 0.5. The coefficient of adhesion is greater than that of friction and incidentally this partly explains why a motor car stops more rapidly when the wheels are kept moving than when they are locked; hence the increased danger when a car skids if the rear wheels are locked by the brakes.

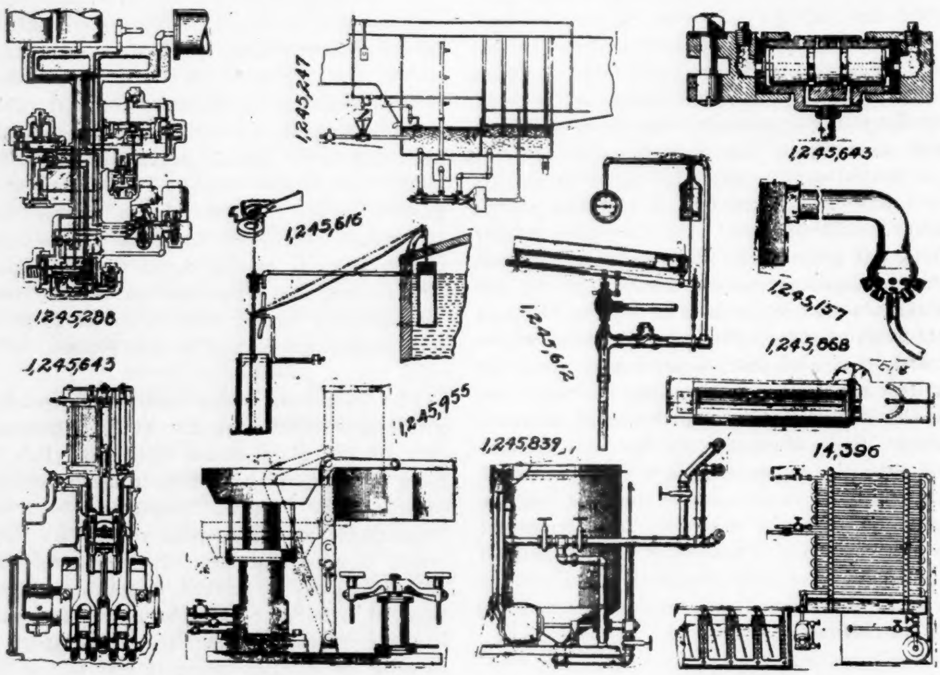
The important temperatures in window glass manufacture are the working temperature of the glass—about 1,500 deg. Fah. in hand blowing, and 1,750 deg. in machine blowing—and the "setting temperature," or the temperature at which glass retains its form, which is about 850 deg. In the liquid state in which glass is worked in machine operations, it is so soft as to be extremely sensitive to changes in temperature or variations in exterior or interior pressure exerted at the point of draw.

The first locomotive for American war-service railroads in France was completed by the Baldwin Locomotive Co. in twenty working days, and thirty engines of this type are now being turned out each day. This is in spite of the fact that the superheater boiler is used and must be constructed especially for this engine. The locomotive weighs about 166,400 pounds, and with the tender, about 275,000 pounds. Like all the equipment, it is painted battleship gray and bears the letters "U. S. A."

During cold weather we experienced considerable difficulty in pumping oil from the railroad spur to the gas works through about a

quarter of a mile of 4-in. pipe. In order to cut down the pipe friction a valve was placed on the intake of the pump so that a certain quantity of air was admitted with the oil. This reduced the volume of oil in the pipes and the friction enough so that the pump could handle the oil without excessive pressure. This device saved the installation of a steam boiler to heat the oil.—*Wrinkle Dept. P. C. G. A.*

vidual unit and the rate of diffusion of gases through it is comparatively low. Because of its low specific gravity it has a very low specific volume, which thus brings its cost within range of common purposes. Perhaps one of the most important uses to which it has been put is in the preparation of life preservers. It will not waterlog, is light, conforms easily to the lines of the body, and is not to be ruined by a pin prick. A life raft made with rubber sponge is as near fool-proof as one can be.



PNEUMATIC PATENTS NOVEMBER 6

France and England freely acknowledge that they greatly decreased their efficiency by sending their scientific men to the trenches. Although they have since withdrawn most of those still alive and are now using them in special service, the dearth of technically trained men has been and is severely felt.

Because of its cellular structure rubber sponge has several very peculiar properties. For example: it has the lowest apparent specific gravity of all solid bodies, being around 0.05, or about one-fifth that of cork. In spite of its cellular structure it is water tight, and very nearly gas tight. While it is honeycombed with minute cells, each cell is an indi-

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LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

NOVEMBER 6

1,245,165. AIR-PRESSURE-PRODUCING ATTACHMENT FOR GASOLINE-TANKS. Reason C. Tharp and Pearley G. Buckles, Osceola, Mo.

1,245,157. HAIR WAVING AND DRYING APPARATUS. Hannah Jacobs and Harry Jacobs, New York, N. Y.

1,245,247. METHOD FOR PURIFYING AND HUMIDIFYING AIR. Adolph W. Lissauer, New York, N. Y.

1,245,288. ELECTROFLUID - PRESSURE BRAKE. Walter Turner, Wilkinsburg, Pa.

1,245,401. AIR-PUMP. John K. Tomlinson, Ronceverte, W. Va.
1,245,603. VIBRATOR. Wilfred Lewis, Haverford, Pa.
1,245,612. VACUUM-PUMP. Edward O'Mara, St. Louis, Mo.
1,245,616. AUTOMATIC WATER-SUPPLY REGULATOR FOR WINDMILLS. Walter F. Pressler, Tosca, Tex.
1,245,629. PNEUMATIC CLEANER. Joseph J. Smith, Cambridge, Mass.
1,245,643. AIR-COMPRESSOR. William Everett Ver Planck, Erie, Pa.
1,245,839. METHOD OF AND APPARATUS FOR DISINTEGRATING AND DECOLORING PAPER. Stewart Waring, Evanston, and Herbert A. Hauptli, Chicago, Ill.

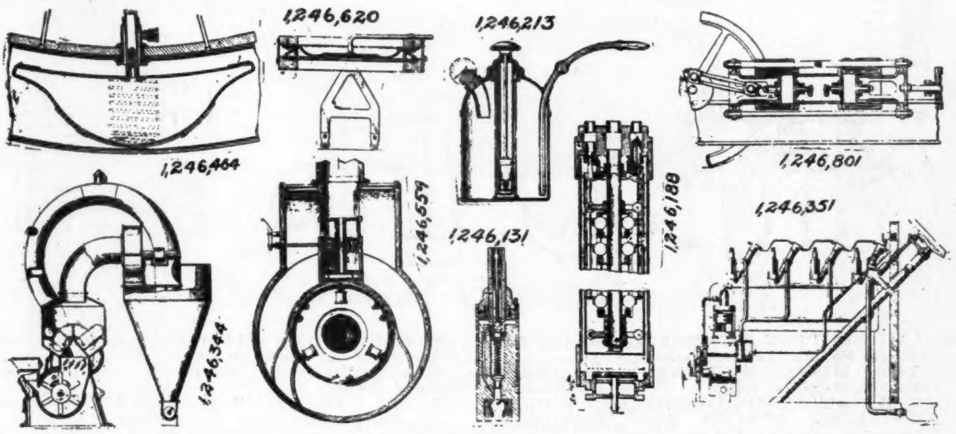
1. A process of disintegrating and deinking printed paper consisting in agitating a body of water containing a quantity of printed paper, saponifying the oily or fatty elements of the mixture, introducing air into the mixture during the agitating and saponifying operation, and removing the resulting foam.

1,245,867. APPARATUS FOR CREATING ARTIFICIAL BREATHING. Otto Buchhorn, Charlottenburg, Germany.
1,245,868. PNEUMATIC CONVEYER. Charles B. Caffey, Elgin, Tex.
1,245,955. COMBINATION JOLT-RAMMING AND ROCK-OVER MACHINE. William C. Norcross, Terre Haute, Ind.
14,390 (Reissue). PROCESS OF AGITATING WATER IN MAKING ICE. Willis B. Kirkpatrick, Hartsdale, N. Y.

1. A process of agitating water by air in the manufacture of ice which consists in providing a supply of dehydrated air at a pressure of from twelve to twenty-five pounds above atmosphere, passing said air through a conduit within the mass of water to be frozen, reducing the pressure of the air before it is released to a point slightly in excess of that of the atmosphere, and delivering said air into the water near the bottom of the mass.

NOVEMBER 13

1,246,131. COMBINED TIRE-VALVE AND PRESSURE-GOVERNOR. George F. Marston, Pomona, Cal.
1,246,188. WATER-ELEVATING APPARATUS. George Franklin Van Brunt, Kewanee, Ill.
1,246,213. PNEUMATIC ATOMIZER. Eduardo Zawels and Estanislao Zawels, Buenos Aires, Argentina.
1,246,344. PNEUMATIC SEPARATOR FOR PULVERIZING-MILLS. Edward J. Steckle, Dixon, Ill.



PNEUMATIC PATENTS NOVEMBER 13

1,246,351. STARTER MECHANISM FOR INTERNAL-COMBUSTION ENGINES. Frank E. Ten Eyck, Auburn, N. Y.
1,246,464. INFLATING DEVICE FOR PNEUMATIC TIRES. Alfred H. Randall, Bridgeport, Conn.
1,246,543. MEANS FOR PREVENTING CLOGGING OF THE WORKING BARRELS OF PUMPS. Robert E. Carmichael, Damon, Tex.

1. The method of preventing clogging of the working barrel of a pump, consisting of providing passages leading into the said working barrel, of connecting said passages to a source of fluid under pressure and of so controlling said passages that the fluid under pressure is continuously introduced to the working barrel during each working stroke of the pump.

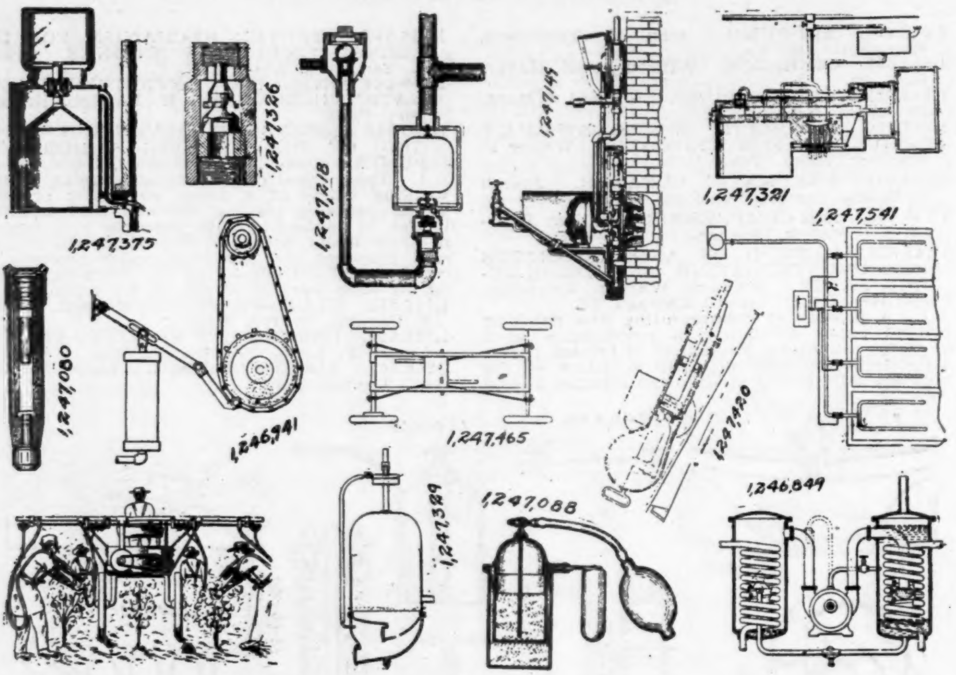
1,246,559. FLUID-PRESSURE MOTOR. Mark S. Darling, Conrad, Mont.
1,246,620. PNEUMATIC PRINTING-FRAME. Lionel F. Levy, Philadelphia, Pa.
1,246,801. AIR-COMPRESSOR. Henry Bolthoff, Denver, Colo.

NOVEMBER 20

1,246,849. PROCESS OF REFRIGERATION. John C. Bertsch, Edgewood Park, Pa.
1,246,941. ENGINE-STARTER. James Edward Sandeson, Danville, Ill.
1,247,064. MULTISTAGE BLOWER FOR PNEUMATIC CLEANERS. George W. Allen, Boston, Mass.
1,247,080. PNEUMATIC TOOL. Charles Christiansen, Gelsenkirchen, Germany.
1,247,088. SPRAYING INSTRUMENT. Thomas A. De Vilbiss, Toledo, Ohio.
1,247,149. AUTOMATIC FUEL CUT-OFF FOR OIL-BURNERS. William R. Ray, San Francisco, Cal.

1. In combination, oil-supply means and air-supply means, a cut-off valve for controlling said oil-supply means, a diaphragm adapted to be actuated by the air pressure of said air-supply means, a pivoted locking lever actuated by said diaphragm and formed with a seat, and a weighted operating lever for said cut-off valve having a laterally extending pin for engaging in the seat of the locking lever to hold said weighted lever releasably.

1,247,218. AIR-ELIMINATOR. William J. Burkart, Pittsburgh, Pa.
1,247,321. MEANS FOR AUTOMATICALLY LUBRICATING CAR JOURNAL-BOXES. Otto M. Paskins, Mattoon, Ill.
1,247,326. PNEUMATIC VALVE. Winfield P. Porter, New York, N. Y.
1,247,329. MILKING-MACHINE RELEASER. Ambrose Ridd, New Plymouth, New Zealand.
1,247,375. AIR-MOISTENER FOR STEAM-CONTAINERS. John A. Clark and Clifford H. Coon, Brooklyn, N. Y.



Pneumatic Patents November 20

1,247,387. COTTON-PICKING MACHINE. William L. Fodrfa, Little Rock, Ark.

1,247,420. MINING-MACHINE. Nils David Levin, Columbus, Ohio.

1,247,465. AIR-COMPRESSING AND SHOCK-ABSORBING SYSTEM FOR VEHICLES. Richard G. Spink, Gibbon, Nebr.

1,247,541. PURIFICATION OF SEWAGE AND OTHER LIQUIDS. Walter Jones, Stourbridge, England.

1. The process of purifying sewage or other impure liquid by supplying the sewage or impure liquid to a tank, supplying or delivering air in small bubbles, periodically, a plurality of times at different points to the liquid in the tank during its treatment, until it is purified, and running off the purified liquid.

NOVEMBER 27

1,247,623. AIR-DISPENSING MEANS. Samuel D. Black, Baltimore, and Alonzo G. Decker, Orangeville, Md.

1. The combination with a post or pedestal having an upper compartment constituting a hollow head and having air intake and outlet passages located in different walls of said head, an air cooled air compressor mounted in said hollow head and arranged to draw air into said head through said intake passage and expel it through said outlet passage.

1,247,835. PNEUMATIC SHOCK-ABSORBER AND AIR-COMPRESSOR. William H. Holden, Idaho Falls, Idaho.

1,247,838. FAN. Fred C. Howe, New Haven, Conn.

1,247,837. SUCTION-SWEEPER. Howard Earl Hoover, Chicago, Ill.

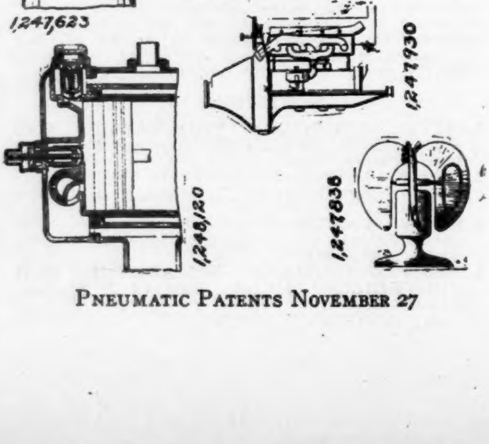
1,247,930. COMPRESSION-BRAKE. Bert L. Campbell, Detroit, Mich.

1. In a compression brake for vehicles, an internal combustion engine having cylinders and pistons operable in the engine cylinders, an exhaust manifold for the engine cylinders, an intake manifold for the engine cylinders adapted to communicate with the atmosphere, means including valves adapted to close said exhaust manifold and open said intake manifold to the atmosphere so that air is compressed in said engine cylinders to retard the action of the pistons therein.

1,247,951. AIR-REGULATING VALVE. Henry M. Fuller, Salt Lake City, Utah.

1,248,119-20. AIR-COMPRESSOR. Fred D. Holdsworth, Claremont, N. H.

1,248,151. AIR-PROPELLER. Samuel D. Mott, Passaic, N. J.



Pneumatic Patents November 27